DIALOGUE ON USING FIRE: A STAKEHOLDER APPROACH WITH FUZZY COGNITIVE MAPS

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BRINGING BACK FIRE...

OBJECTIVES

Convene a series of facilitated community listening sessions, focus groups, and/or shared **learning** and planning workshops …

… enabling the community to collaboratively address barriers and reach agreements

… which define a fire management plan embracing **"right fire"** and informing the agency Wildland Fire Decision Support System

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COLLABORATIVE MODELING

Systems modeling techniques …

… used to adress complex social and environmental problems

… done in a particpatory fashion to help individuals/communities understand and change a system

COGNITIVE MAPS

Visualizations …

… of the collections of beliefs, experiences, and knowledge that people use to orient themselves within an environment

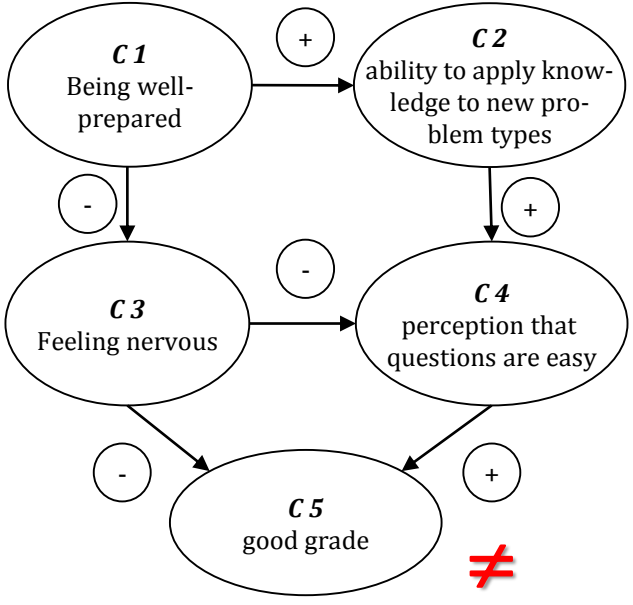
Consist of concepts and relationships between them

Subjective worldviews, not necessarily “true”

(CAUSAL) COGNITIVE MAP

≈

influence diagram
causal map / cause map
causal loop diagram
networked concept map
oval map



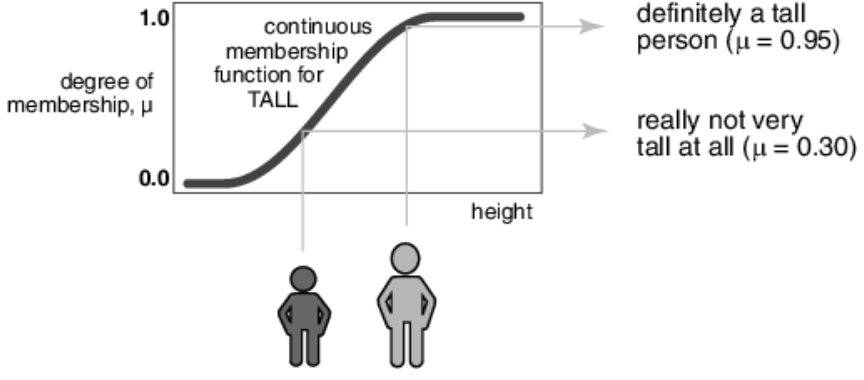
≠

concept maps
mind maps

FUZZY COGNITIVE MAPS

two additions to traditional cognitive maps

- Fuzzy Set Theory (Fuzzy Math)
- Neural Networks



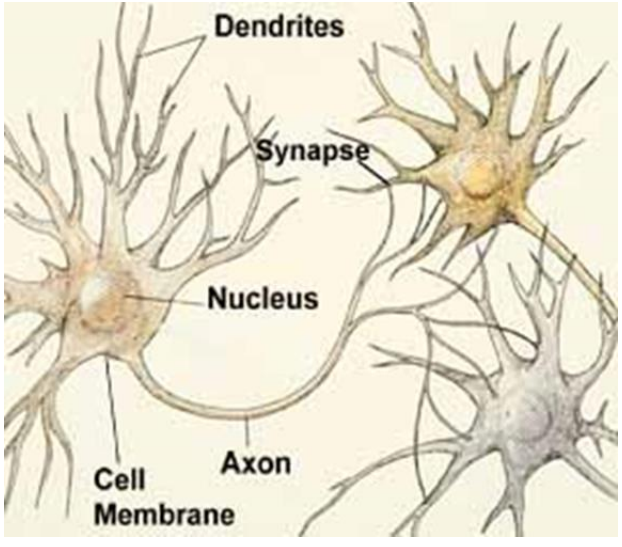


ILLUSTRATION 1

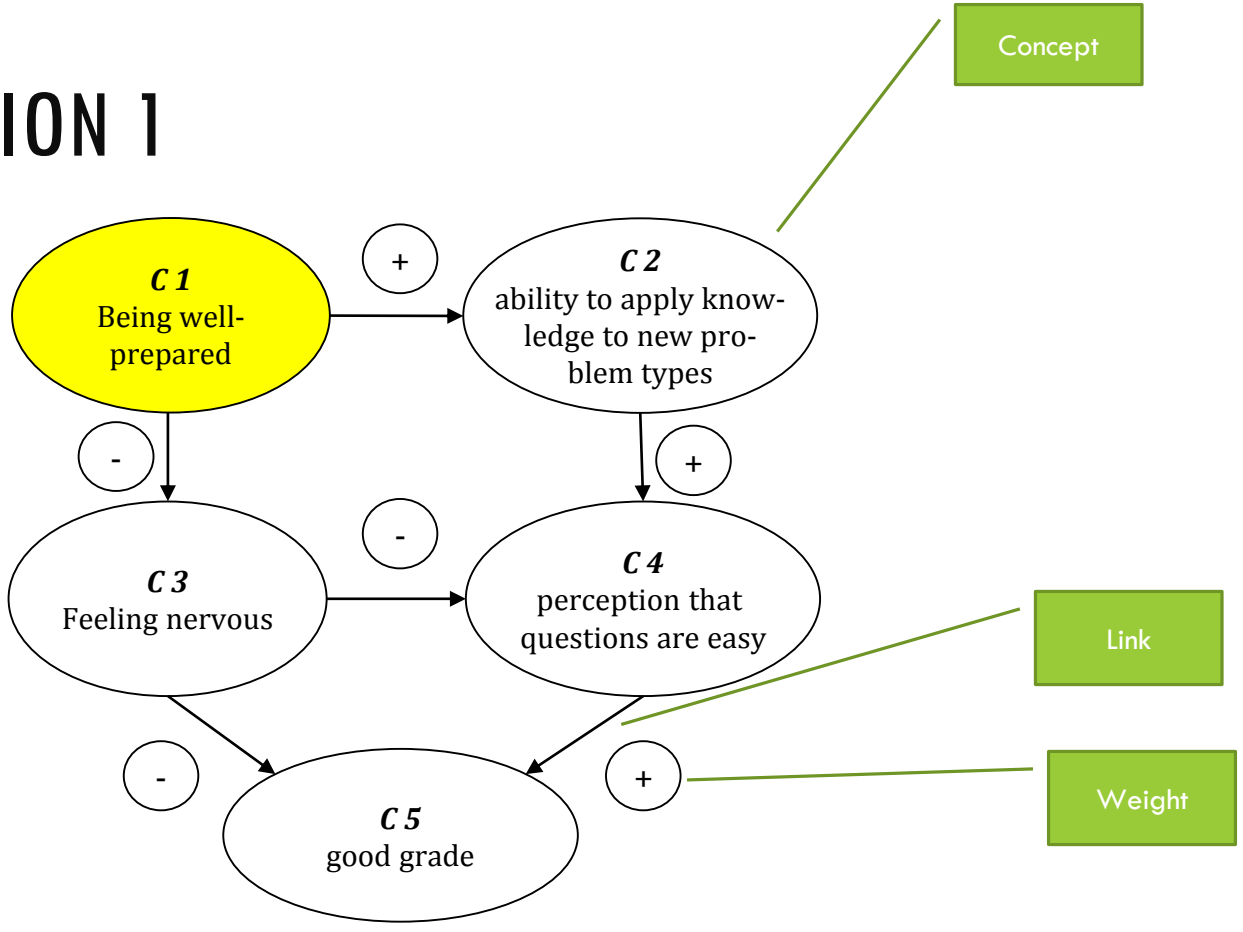


ILLUSTRATION 2

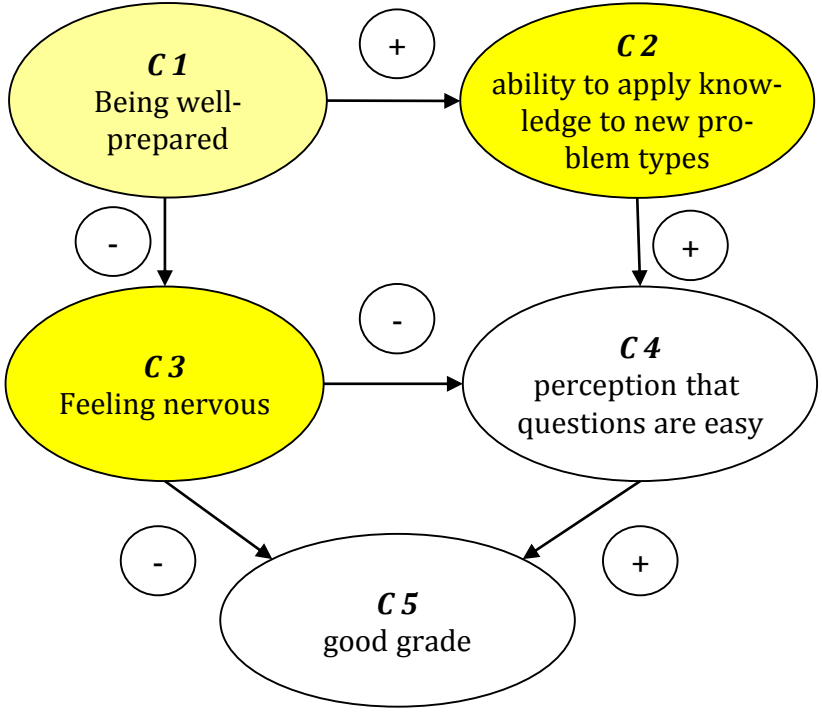
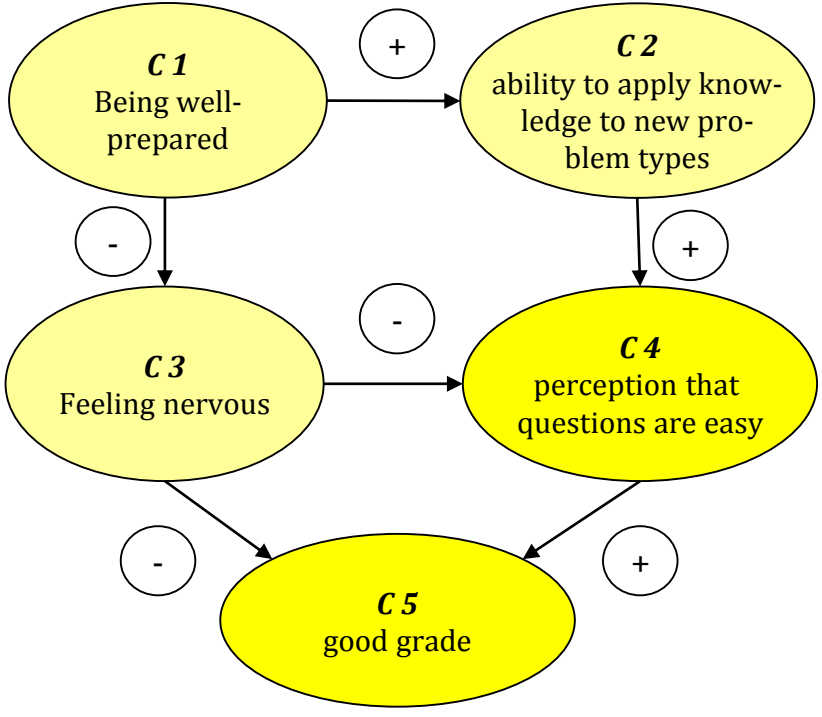


ILLUSTRATION 3



WHY USE FCMS FOR COLLABORATIVE MODELING?

System modeling:

- use qualitative and quantitative information with different dimensions
- open structure that can be easily extended

relatively “simple“: intuitive and well-known cognitive maps, natural language for weights, calculation with basic math

STAKEHOLDER GROUPS

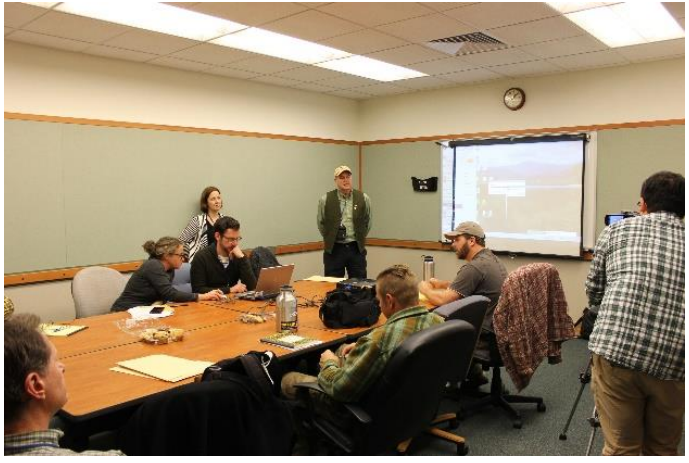
City and County Leadership

Environmentalists

Landowners

Bureau of Land Management

US Forest Service



PHASE 1

5 workshops (2.5 hours each):

Part 1: Survey about communication and beliefs about controlled burning and natural ignition to understand knowledge diversity

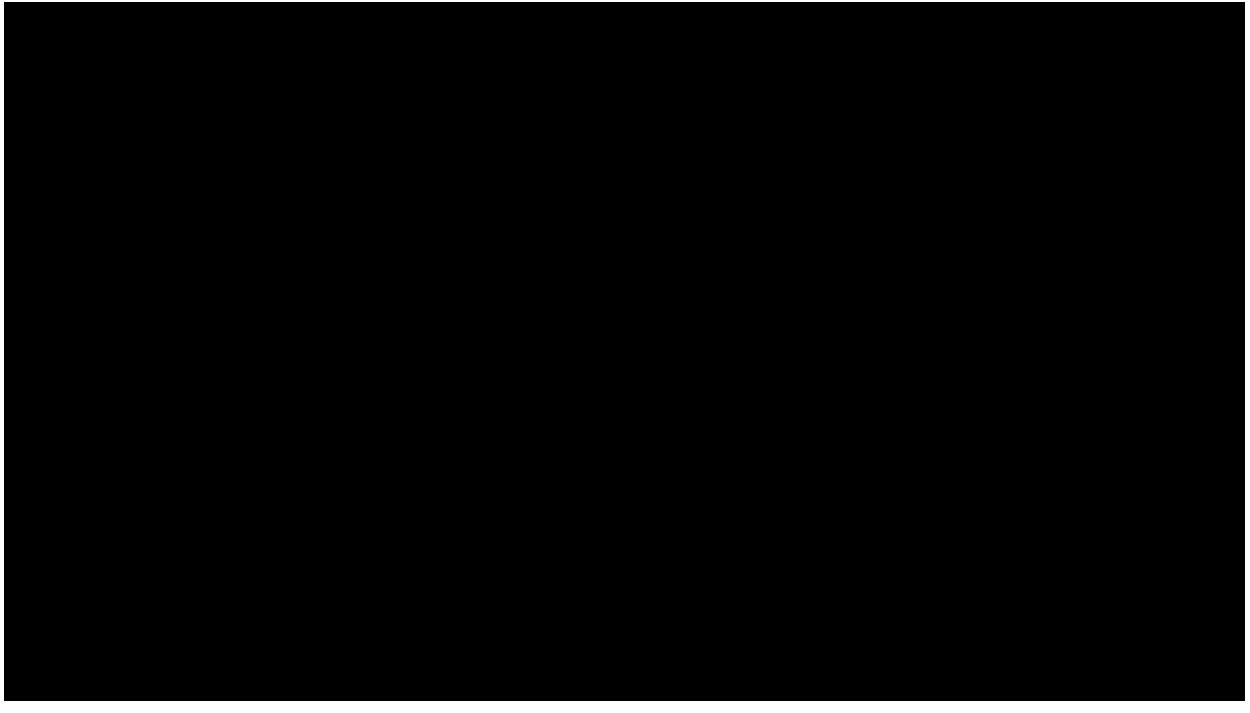
- How often do you interact with each stakeholder group?
- What do you think would happen if….
  - Increased Controlled Burning
  - Increased Managed Ignition
- Who do you think agrees with you?
- Barriers and Solutions to implementing wildfire management policies

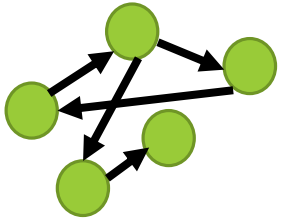
Part 2: Group Modeling exercise using fuzzy cognitive mapping (FCM)

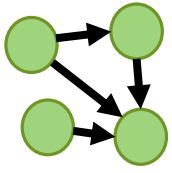
Back in the lab

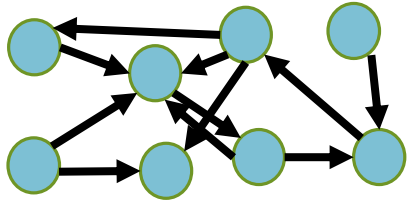
Refine FCM models, test “dynamic hypotheses”, create summary descriptions, integrate stakeholder feedback

EXAMPLE



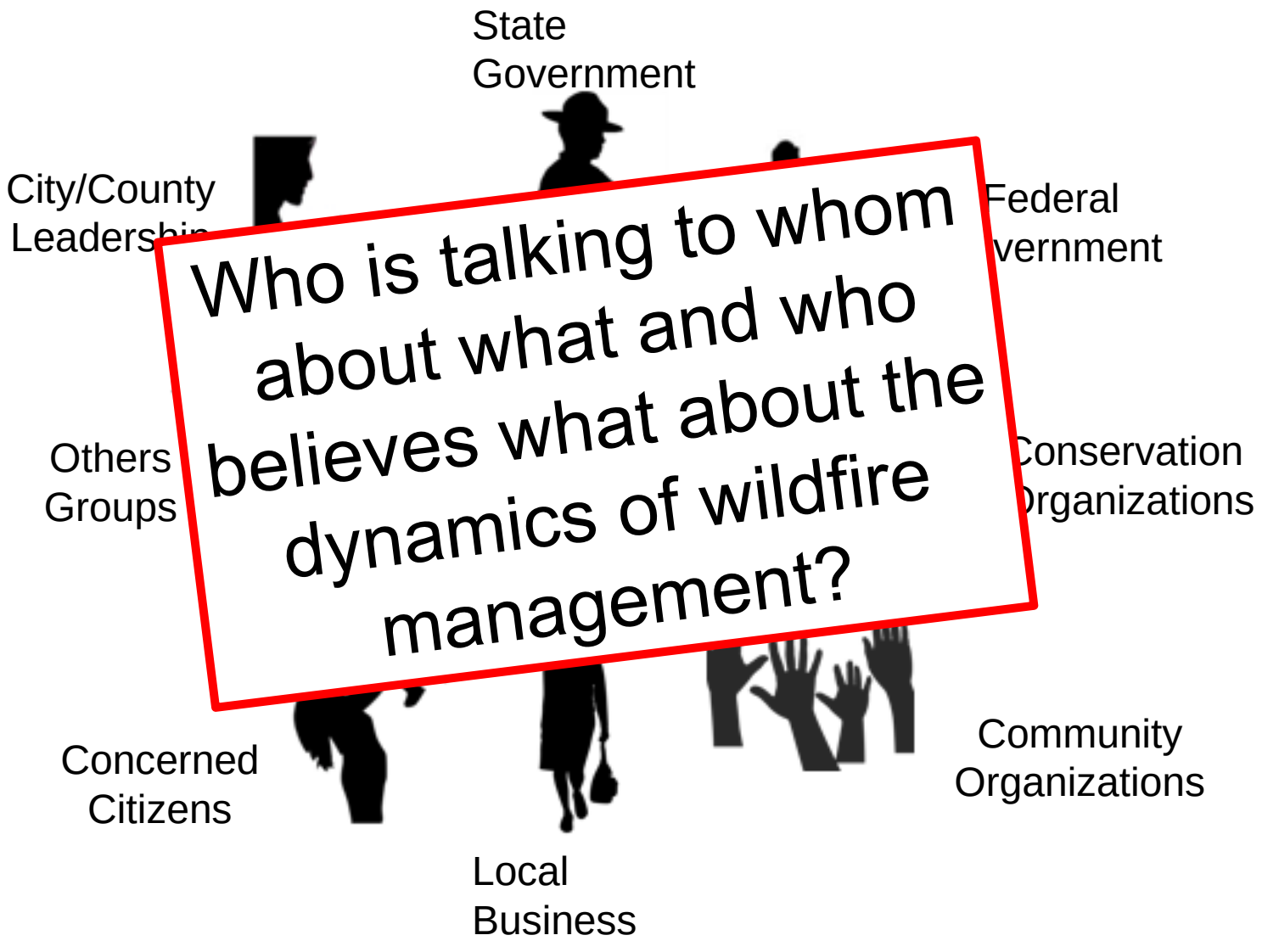






WHAT PEOPLE TALKED ABOUT…

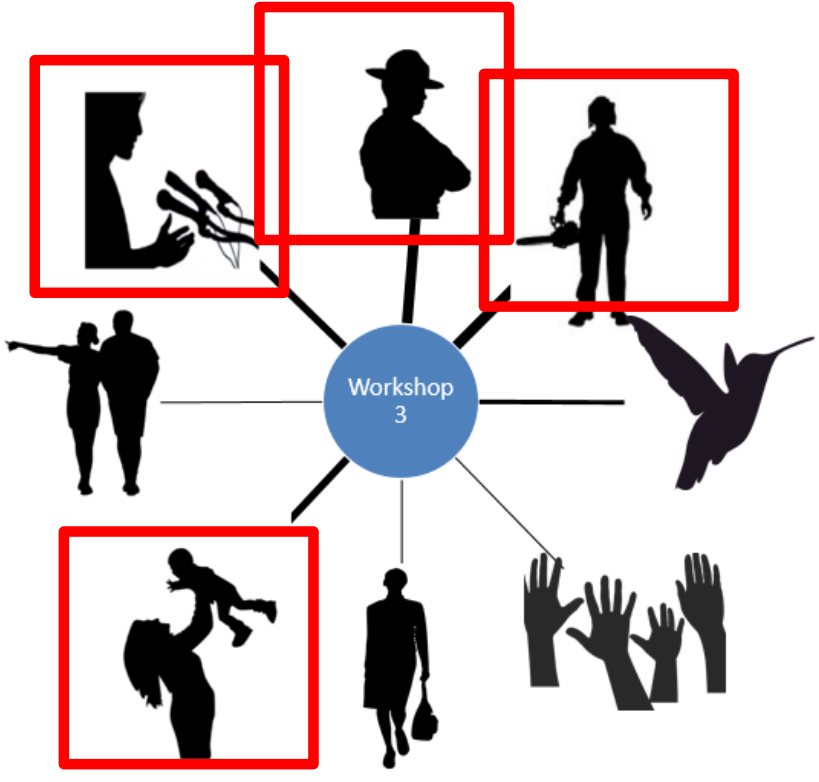
http://www.wordclouds.com


State Government
City/County Leadership
Federal Government
Others Groups
Conservation Organizations
Concerned Citizens
Community Organizations
Local Business
Who is talking to whom about what and who believes what about the dynamics of wildfire management?

CITY/COUNTY LEADERSHIP

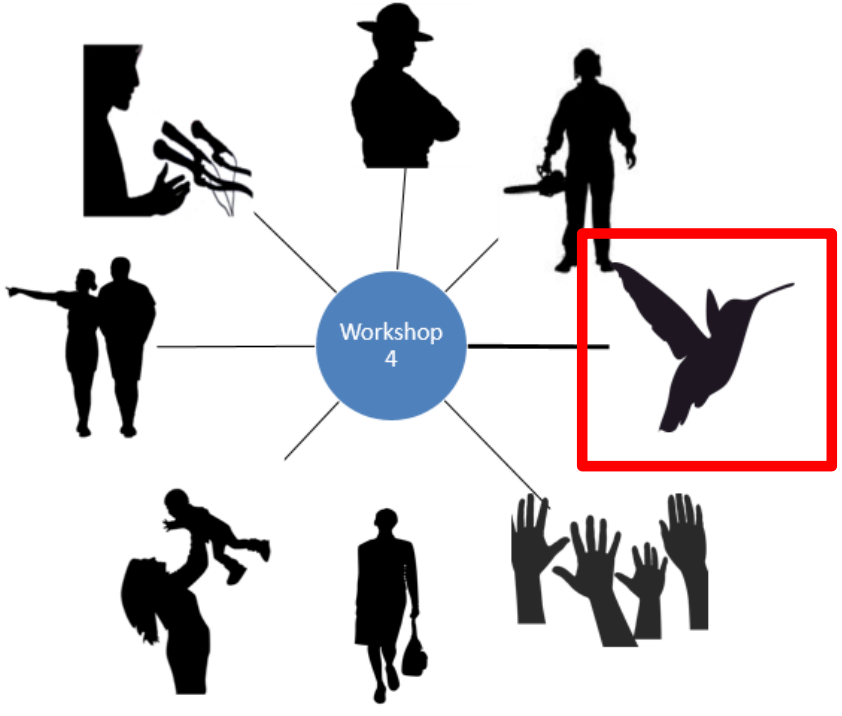
Municipal government and local business experts are talking with everyone– and frequently….

BLM AND ODF



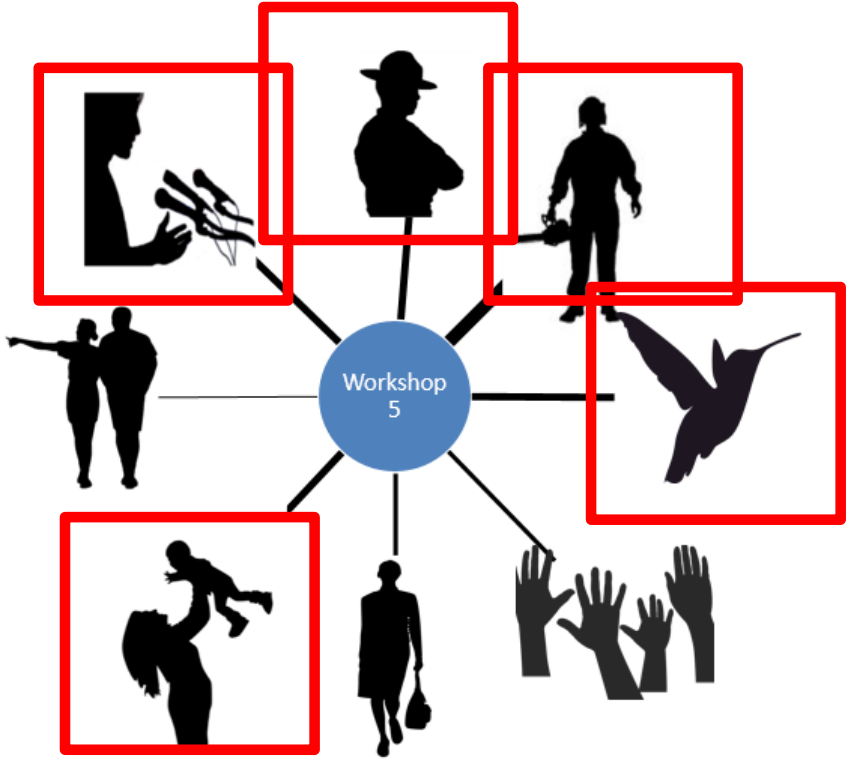
State government (and BLM) are talking with municipal experts and federal managers and with concerned citizens

PRIVATE LANDOWNERS



Large private landowners are largely left out of the loop, but do report interacting more with conservation NGOs

US FOREST SERVICE



US Forest Service is talking with municipal and state managers, conservation NGOs and hearing concerned citizens

WHERE DOES THE UNCERTAINTY ABOUT THE IMPACTS OF WILDFIRE MANAGEMENT EXIST?

OVERALL, WHAT WOULD HAPPEN IF WE INCREASED CONTROLLED BURNING?

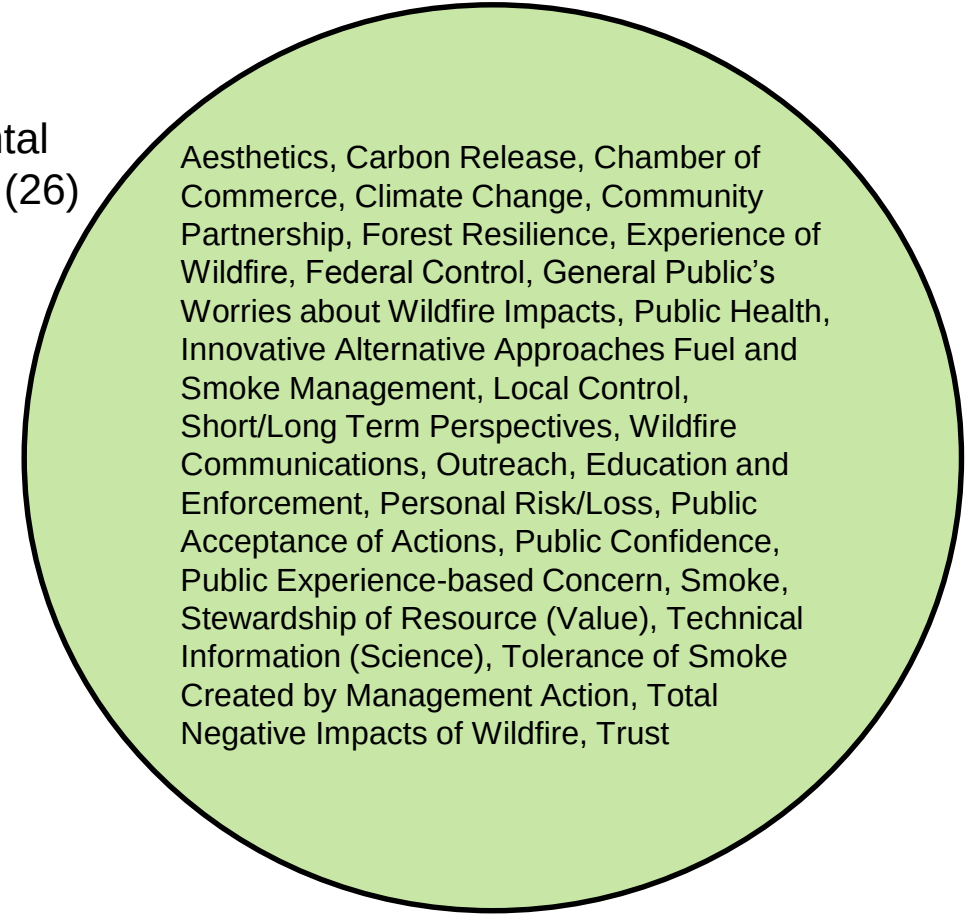
If we Increased **Controlled Burning** what would happen to….	Increase?	Decrease?	No change	
Public Health	34.1	32.1	0	High Uncertainty
Economic Cost	30.1	40.3	2.0	High Uncertainty
Forest Resilience	50.1	7.0	12.4	Low Uncertainty
Public Acceptance	29.0	24.9	4.2	High Uncertainty

OVERALL, WHAT WOULD HAPPEN IF WE INCREASED MANAGED NATURAL IGNITION?

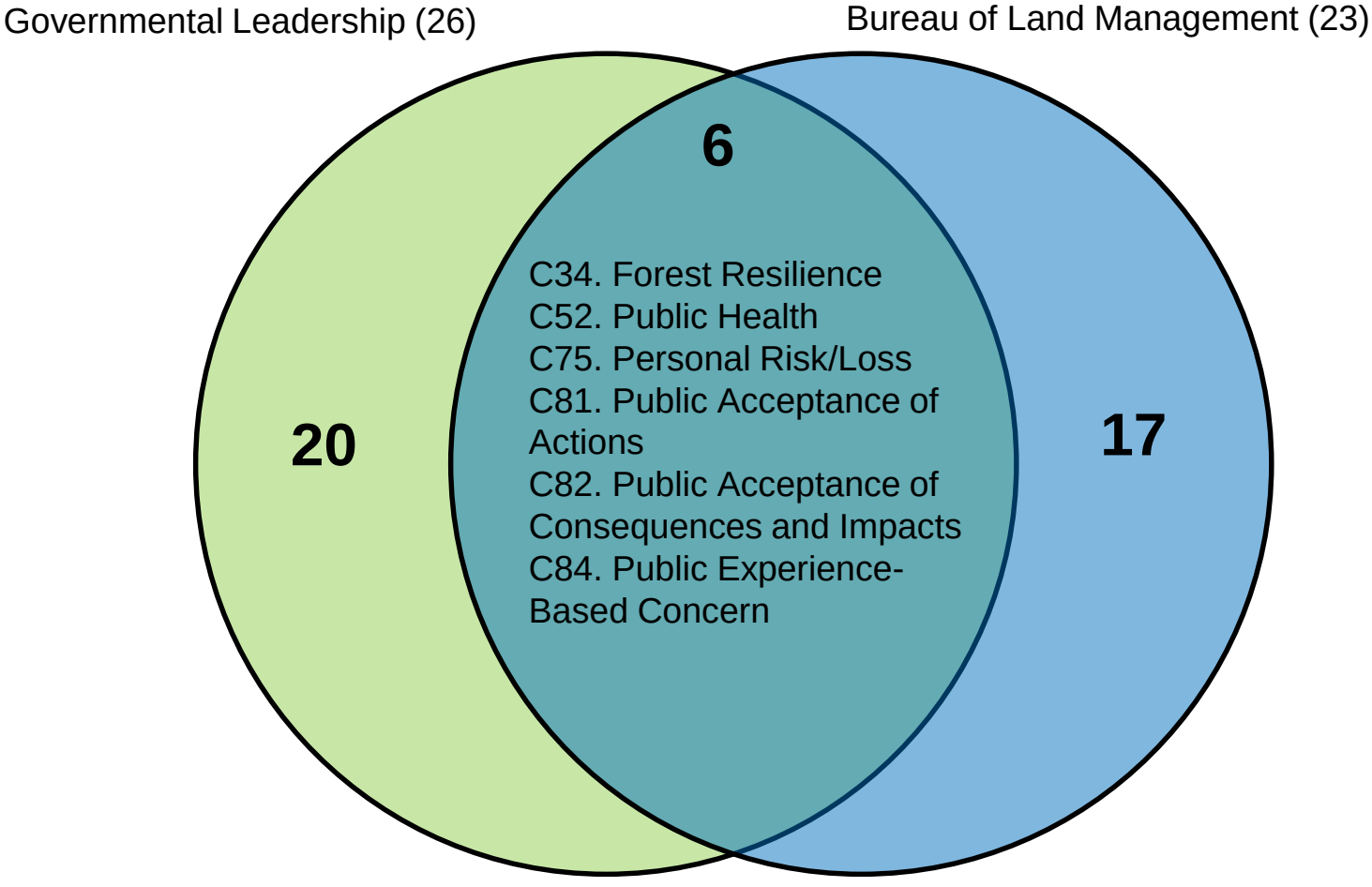
If we Increased **Managed Natural Ignition** what would happen to…	**Increase?**	**Decrease?**	**No change**	
Public Health	15.6	19.6	7.3	High Uncertainty
Economic Cost	9.3	50.6	8.2	Low Uncertainty
Forest Resilience	72.7	3.1	0	Low Uncertainty
Public Acceptance	20.8	19.0	11.4	High Uncertainty

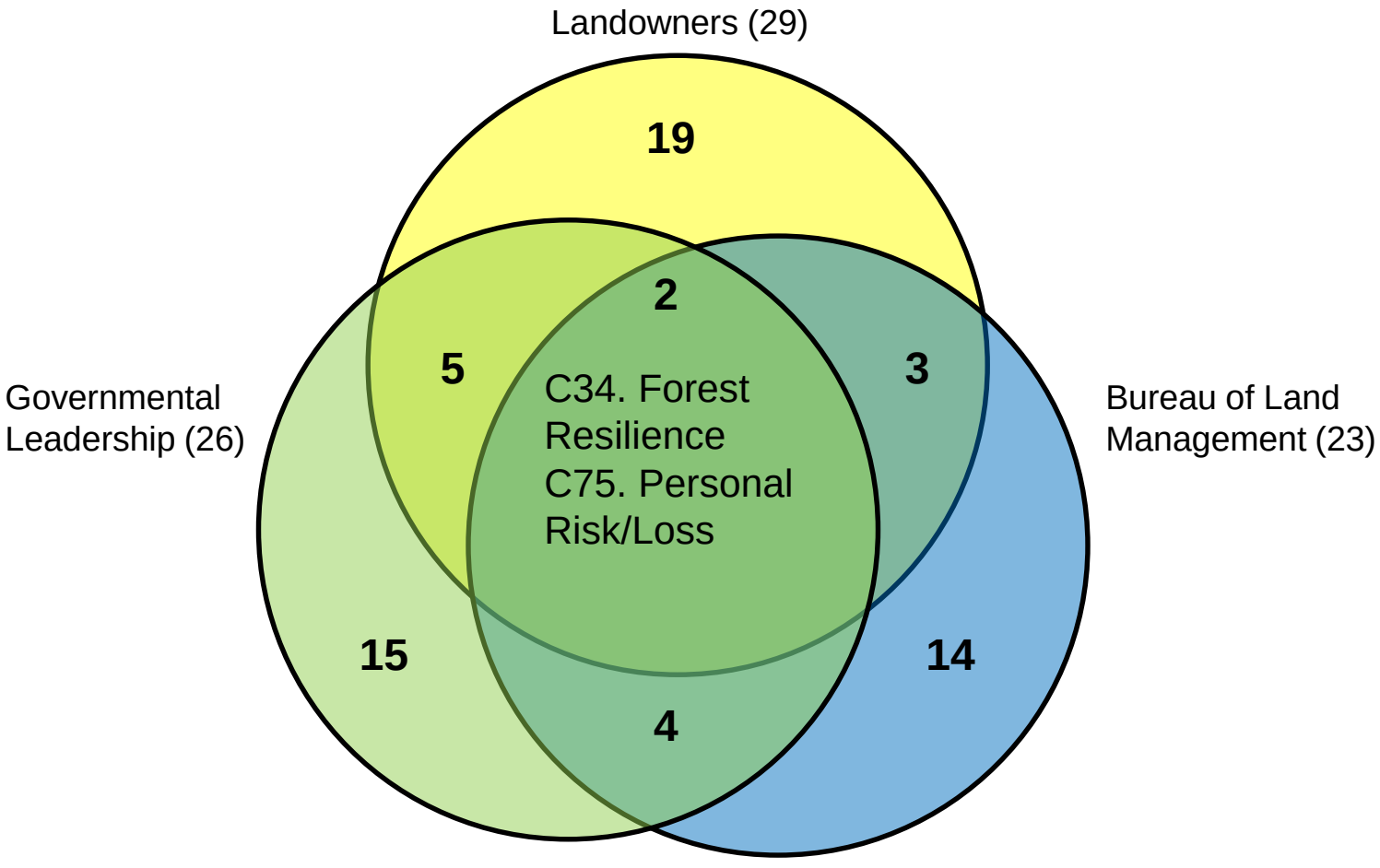
SHARED KNOWLEDGE AND DIFFERENT EXPERTISE…

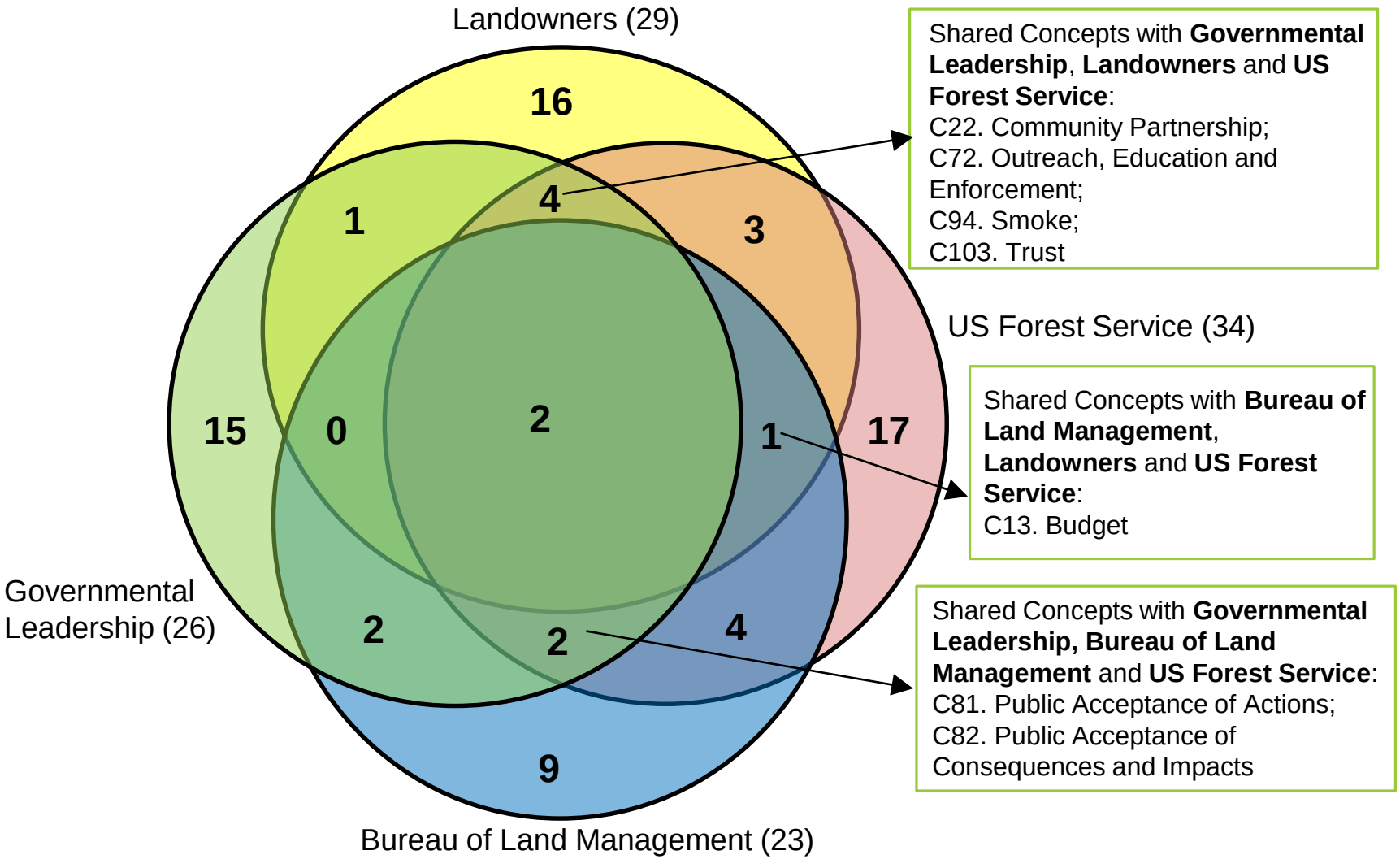
Governmental Leadership (26)

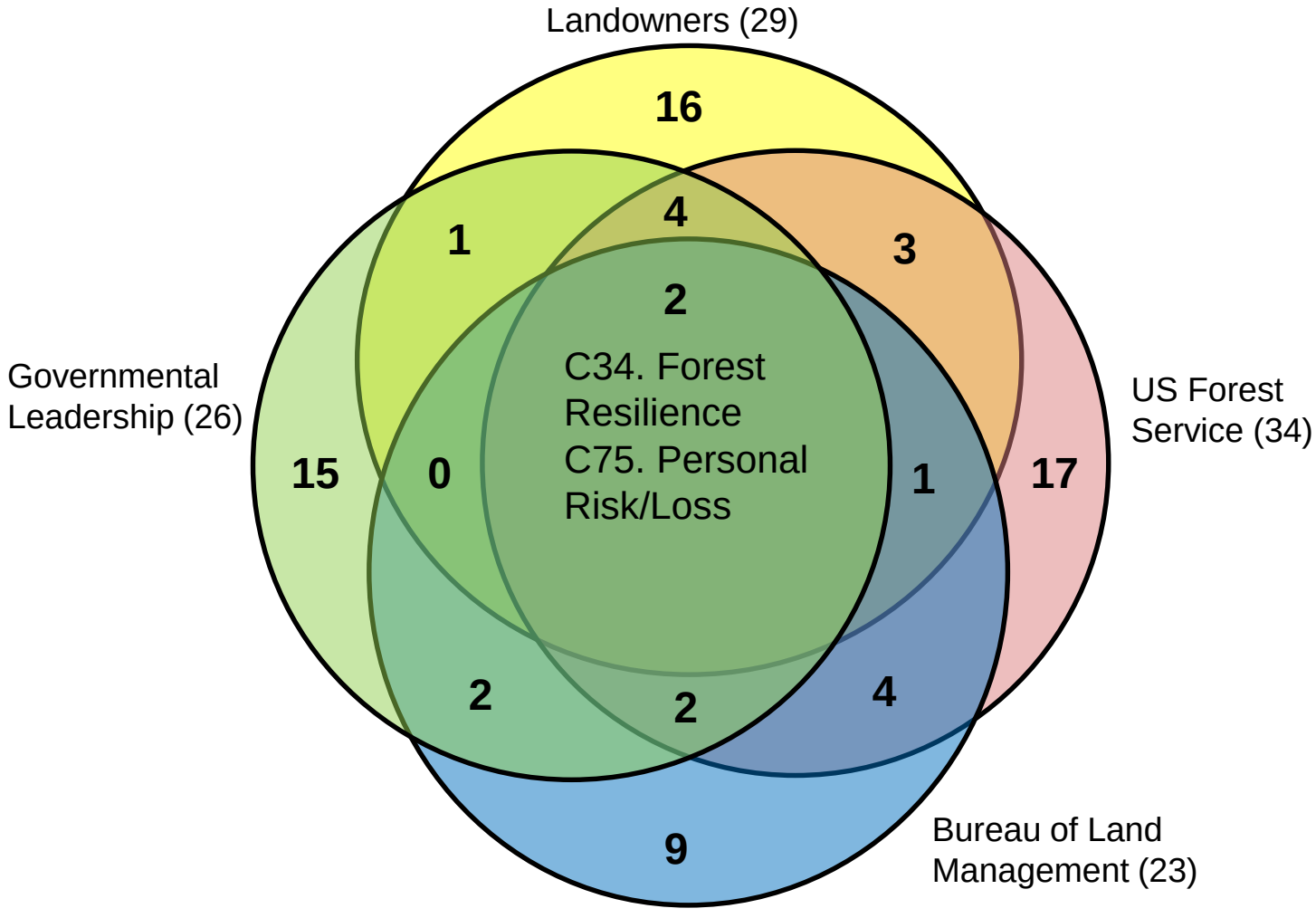


Heberle, H.; Meirelles, G. V.; da Silva, F. R.; Telles, G. P.; Minghim, R. ***InteractiVenn: a web-based tool for the analysis of sets through Venn diagrams***. BMC Bioinformatics 16:169 (2015).


Governmental Leadership (26)
Bureau of Land Management (23)
6
C34. Forest Resilience
C52. Public Health
C75. Personal Risk/Loss
C81. Public Acceptance of Actions
C82. Public Acceptance of Consequences and Impacts
C84. Public Experience-Based Concern
20
17


Landowners (29)
19
2
5
3
C34. Forest Resilience
C75. Personal Risk/Loss
Governmental Leadership (26)
Bureau of Land Management (23)
15
14
4


Landowners (29)
16
1
4
3
US Forest Service (34)
15
0
2
1
17
Governmental Leadership (26)
2
2
4
9
Bureau of Land Management (23)
Shared Concepts with **Governmental Leadership**, **Landowners** and **US Forest Service**:
C22. Community Partnership;
C72. Outreach, Education and Enforcement;
C94. Smoke;
C103. Trust
Shared Concepts with **Bureau of Land Management**, **Landowners** and **US Forest Service**:
C13. Budget
Shared Concepts with **Governmental Leadership, Bureau of Land Management** and **US Forest Service**:
C81. Public Acceptance of Actions;
C82. Public Acceptance of Consequences and Impacts


Landowners (29)
16
1
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C34. Forest Resilience
C75. Personal Risk/Loss
Governmental Leadership (26)
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US Forest Service (34)
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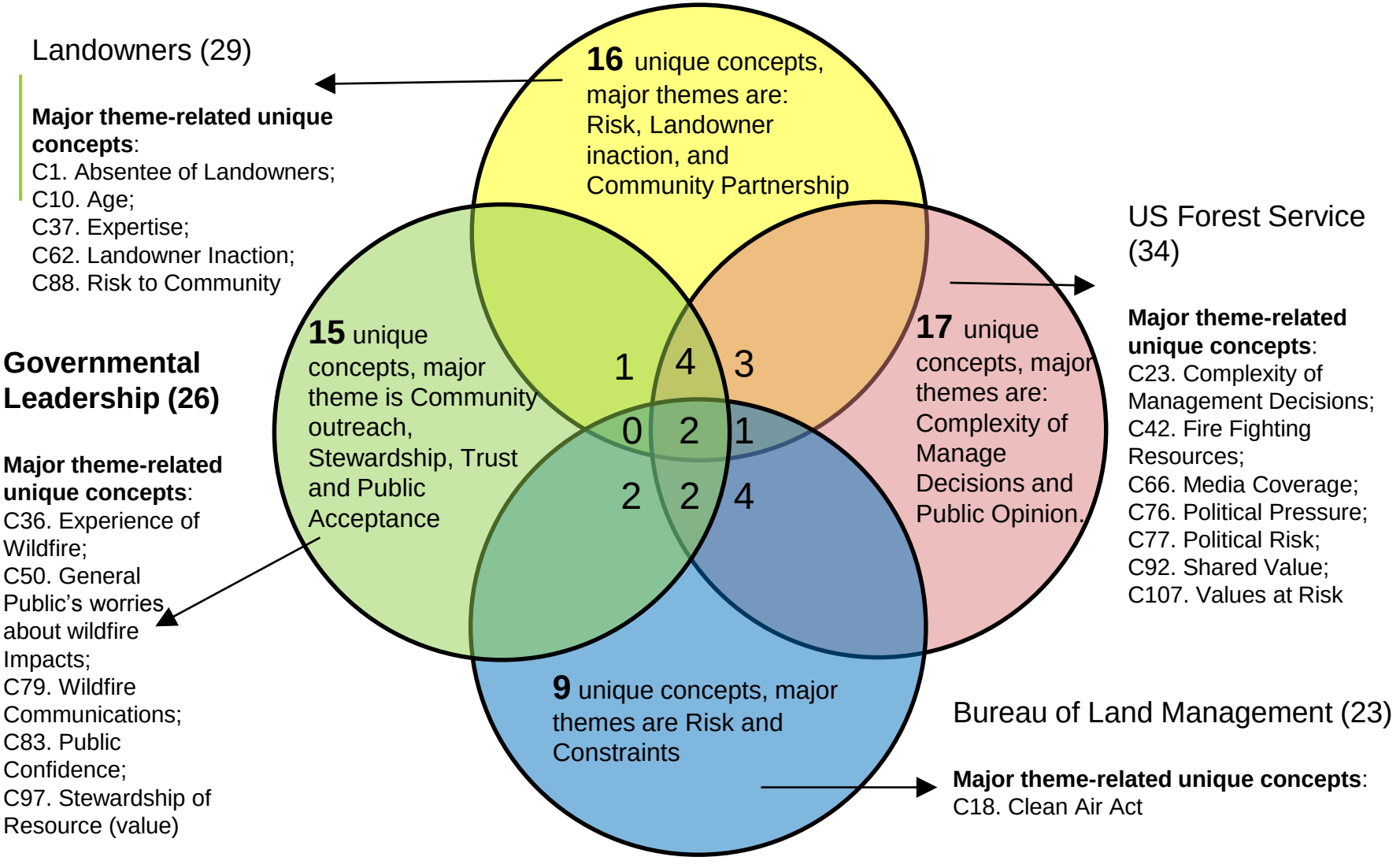
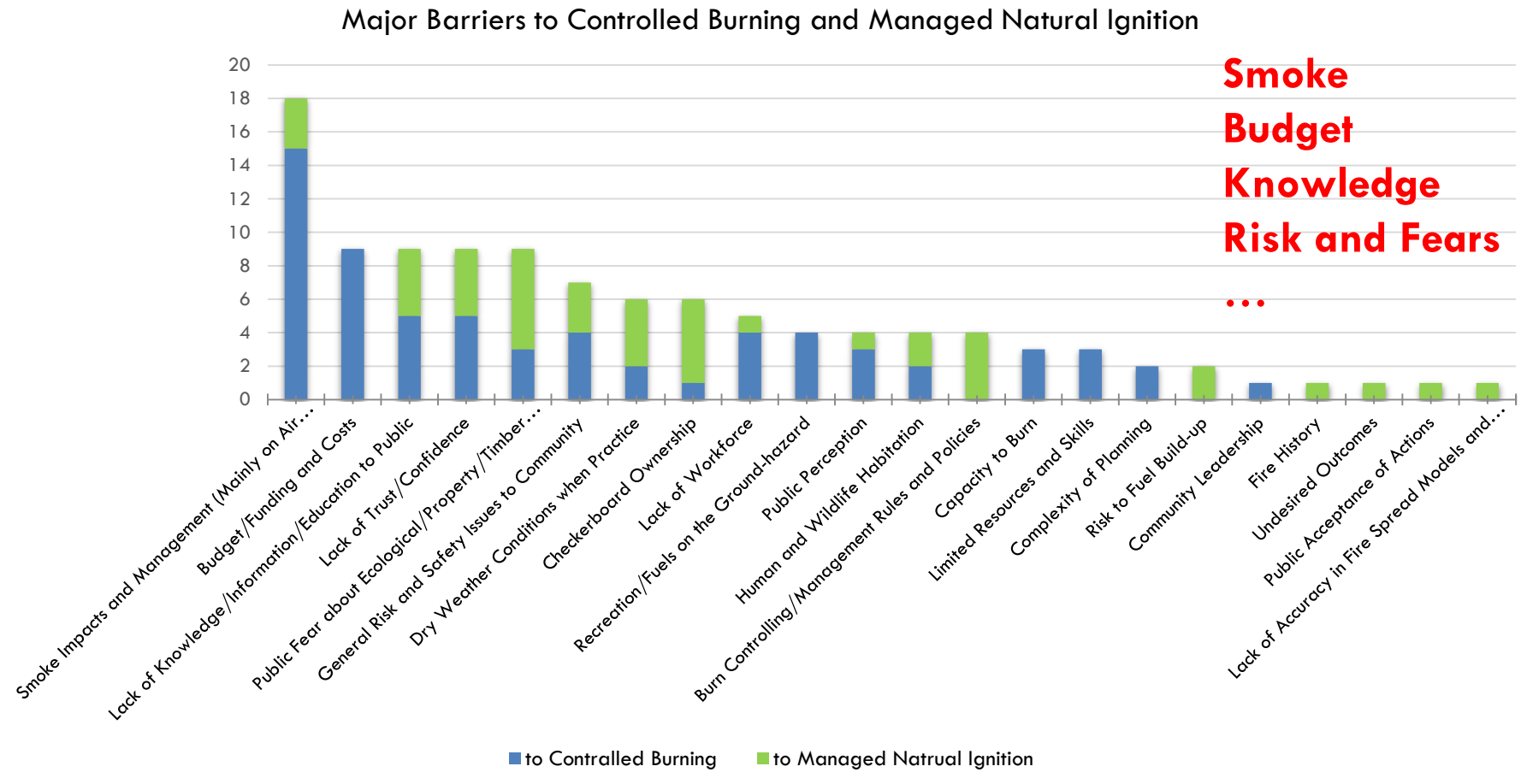
Bureau of Land Management (23)


Landowners (29)
Major theme-related unique concepts:
C1. Absentee of Landowners;
C10. Age;
C37. Expertise;
C62. Landowner Inaction;
C88. Risk to Community
16 unique concepts, major themes are: Risk, Landowner inaction, and Community Partnership
US Forest Service (34)
Major theme-related unique concepts:
C23. Complexity of Management Decisions;
C42. Fire Fighting Resources;
C66. Media Coverage;
C76. Political Pressure;
C77. Political Risk;
C92. Shared Value;
C107. Values at Risk
Governmental Leadership (26)
Major theme-related unique concepts:
C36. Experience of Wildfire;
C50. General Public's worries about wildfire Impacts;
C79. Wildfire Communications;
C83. Public Confidence;
C97. Stewardship of Resource (value)
15 unique concepts, major theme is Community outreach, Stewardship, Trust and Public Acceptance
1
4
3
0
2
1
2
2
4
17 unique concepts, major themes are: Complexity of Manage Decisions and Public Opinion.
9 unique concepts, major themes are Risk and Constraints
Bureau of Land Management (23)
Major theme-related unique concepts:
C18. Clean Air Act


Major Barriers to Controlled Burning and Managed Natural Ignition
20
18
16
14
12
10
8
6
4
2
0
Smoke Impacts and Management (Mainly on Air…
Budget/Funding and Costs
Lack of Knowledge/Information/Education to Public
Lack of Trust/Confidence
Public Fear about Ecological/Property/Timber…
General Risk and Safety Issues to Community
Dry Weather Conditions when Practice
Checkerboard Ownership
Lack of Workforce
Recreation/Fuels on the Ground-hazard
Public Perception
Human and Wildlife Habitation
Burn Controlling/Management Rules and Policies
Capacity to Burn
Limited Resources and Skills
Complexity of Planning
Risk to Fuel Build-up
Community Leadership
Fire History
Undesired Outcomes
Public Acceptance of Actions
Lack of Accuracy in Fire Spread Models and…
Smoke
Budget
Knowledge
Risk and Fears
…
to Contralled Burning
to Managed Natrual Ignition

WHAT INSIGHTS DO WE GAIN FROM THE DIFFERENT FCM WORKSHOPS?

CITY/COUNTY LEADERSHIP

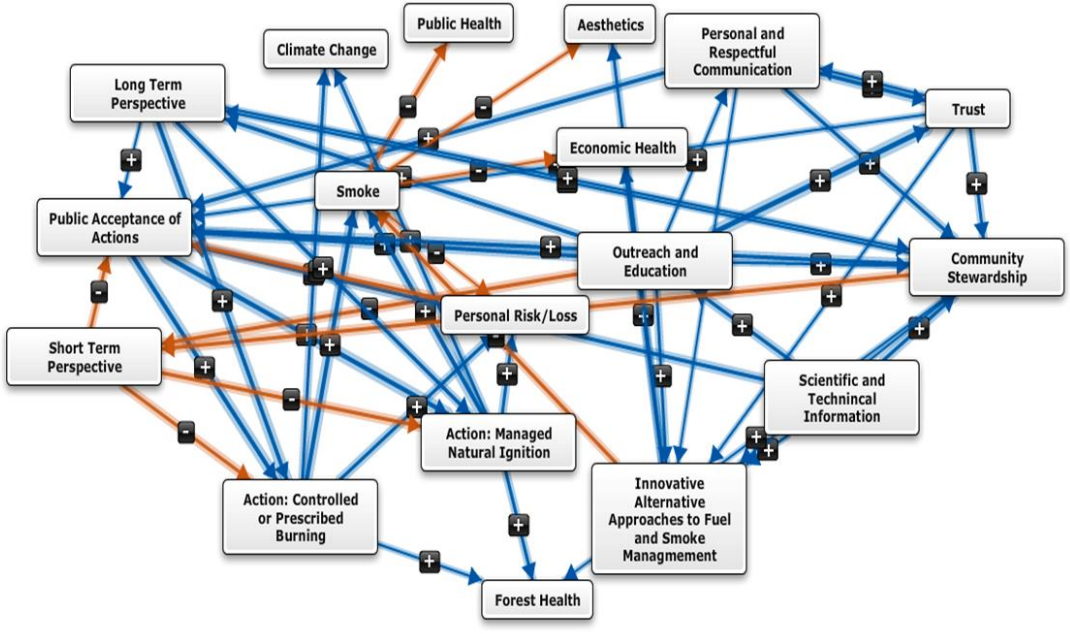
Focus on the *outcomes* of prescribed fire and managed natural ignition

Main concerns

- Health concerns due to smoke
- Risks and Losses (due to fire, due to smoke impacts, …)
- Public Acceptance of the actions.

Approaches to improve public acceptance:

- Coordinated Outreach and Education
- Trust and Communication



BUREAU OF LAND MANAGEMENT

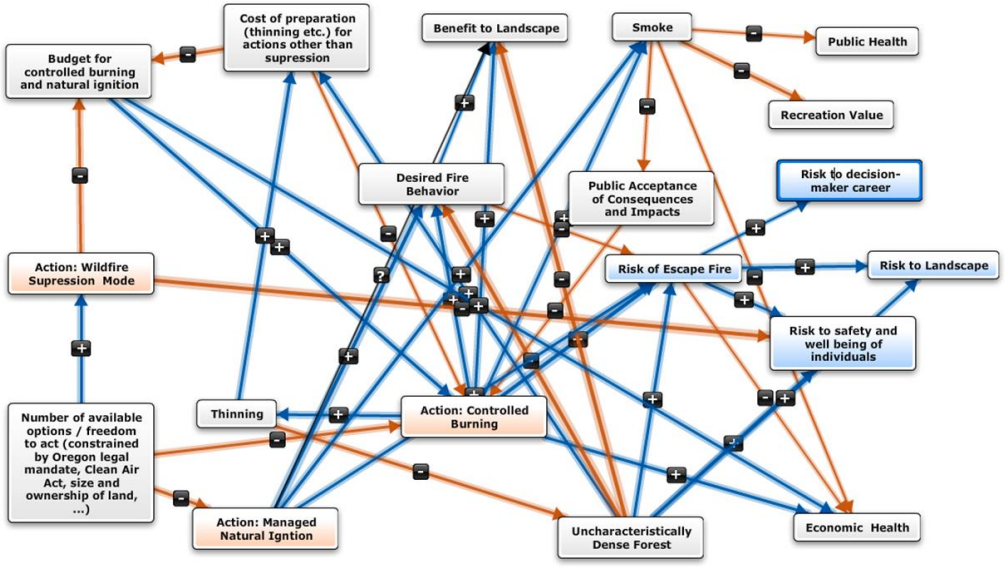
Fire is inherently risky but brings benefits to landscape

BLM faces specific constraints

- State of Oregon
- Clean Air Act
- BLM liability
- …

Controlled burns are perceived as more viable than managed natural ignition

Unclear about the extent of public acceptance for prescribed burns and managed natural ignition.



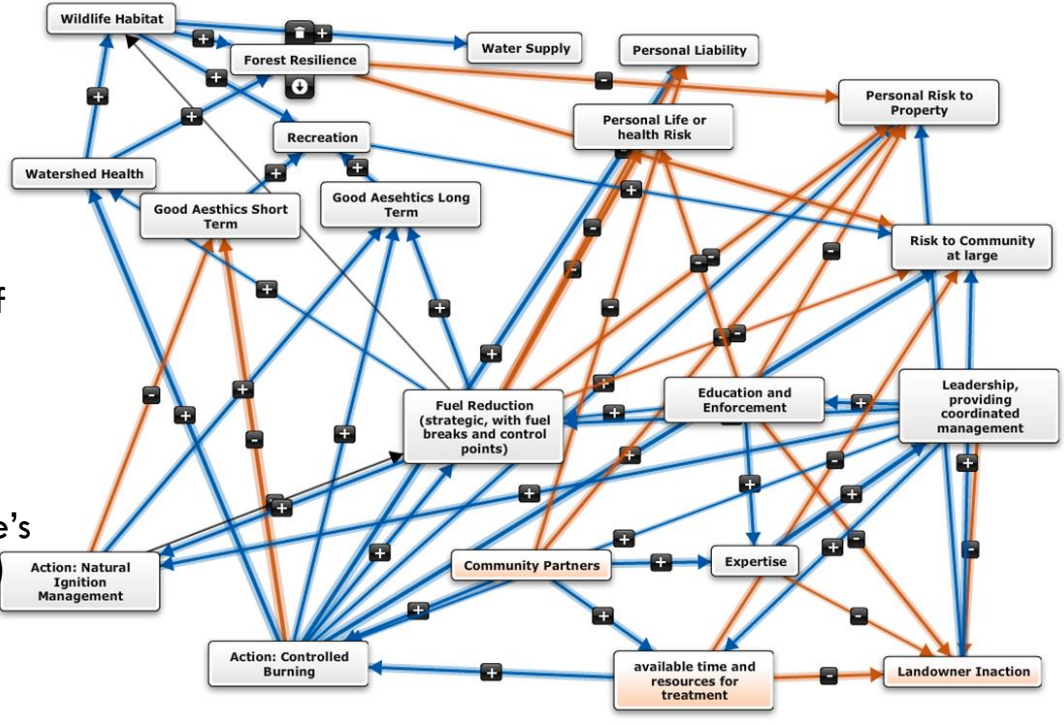
LANDOWNERS

"Herd Immunity": Cumulative individual action improves the situation for everyone

Acknowledgement of the importance of fuel reduction

Barriers to landowners taking action:

- Education / Access to knowledge
- Personal Liability (treatment of one's land affects another person's land)
- Lack of enforcement / absentee landowners
- Resources



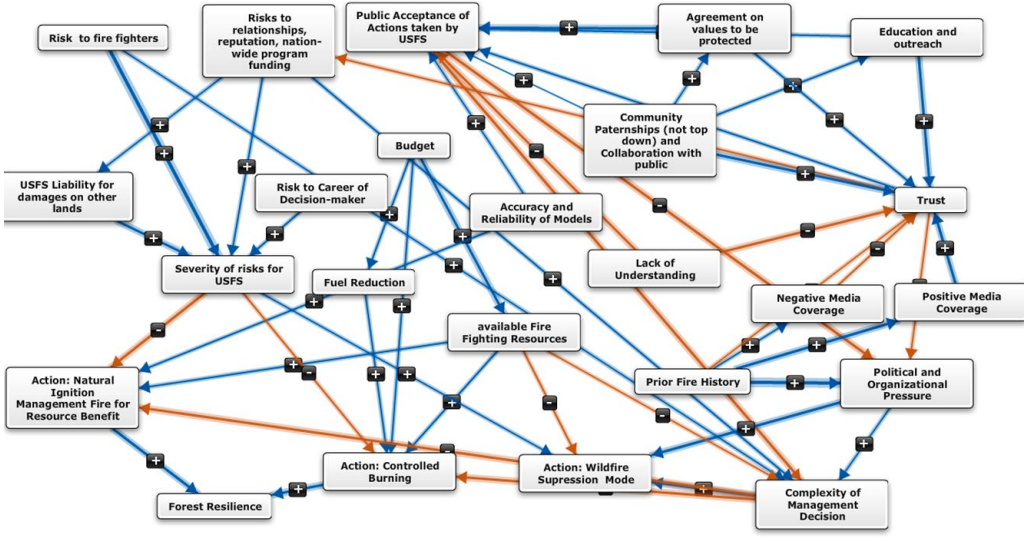
US FOREST SERVICE

Complexity of Management Decision → wildfire suppression as the "default" mode

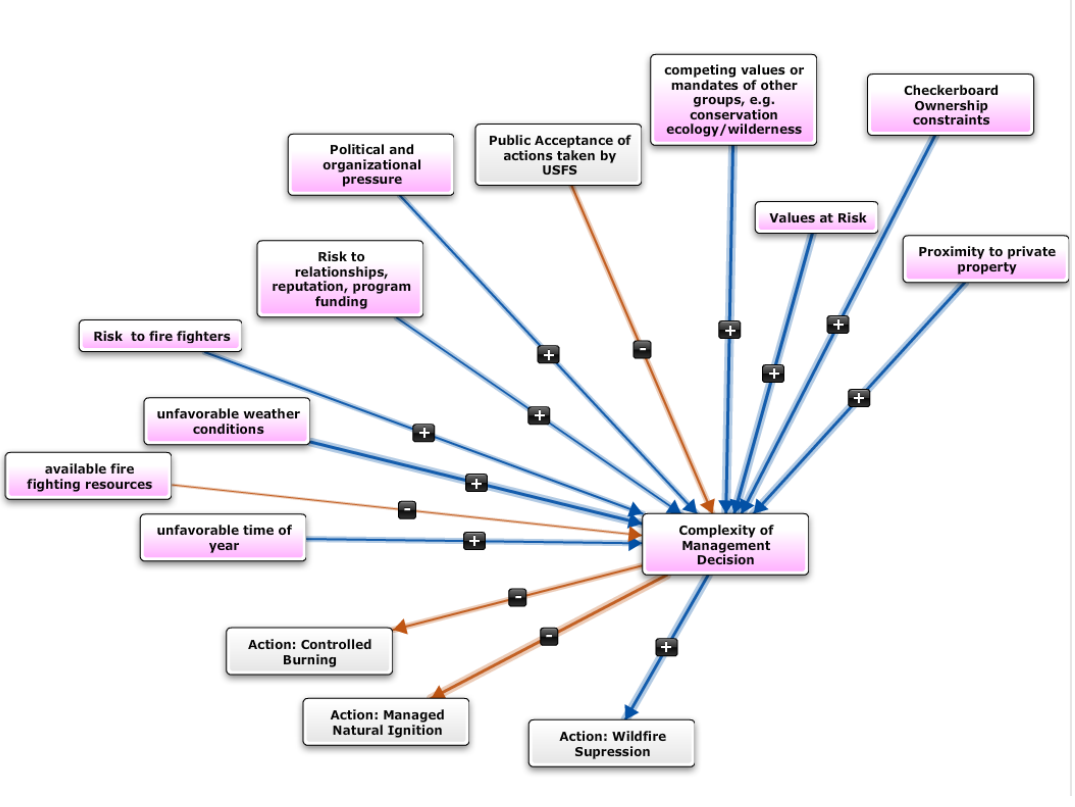
Drivers of Complexity

Acceptance of USFS Actions in Public Opinion

- Community partnerships
- Education
- Public experience with fire



COMPLEXITY OF MANAGEMENT DECISION



MAJOR BARRIERS TO FIRE MANAGEMENT ACTIONS

Municipal/Local Business experts, large landowners and the USFS were more similar in their perceived barriers to implementing wildfire policies:

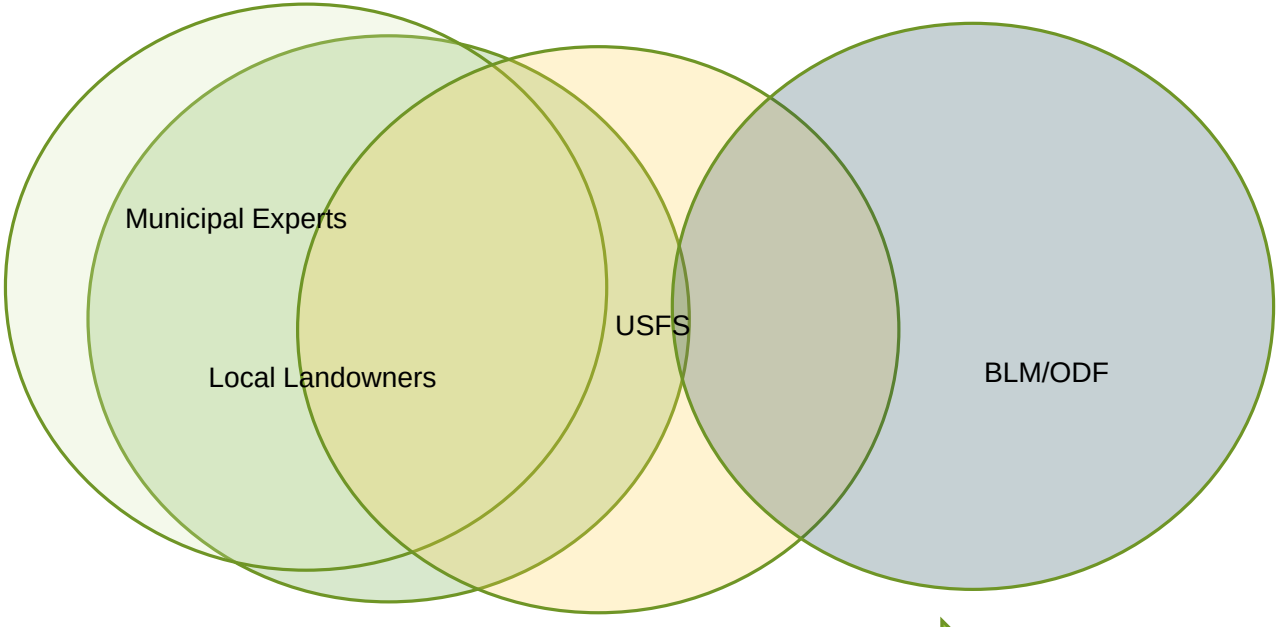
- Increased Smoke
- Impacts to Public Health
- Increased Fuel loads

State (ODF) and Federal Managers (BLM) indicated different barriers:

- Regulations/Laws and Accountability
- Funding
- Leadership/Planning

Everyone agreed that lack of public awareness and education was the major driving issue that limits use of wildfire

BARRIERS TO INCREASING WILDFIRE MANAGEMENT



Barriers due to perceived social impacts → Management, planning, logistics and risk management

FINDINGS PHASE 1 … SO FAR

There is considerable variation in within stakeholder groups (as opposed to between stakeholder groups)

Some agreement that the two wildfire management policies would *increase forest resilience and reduce economic cost*

Uncertainty about how these practices will impact public health and public acceptance of these management policies

Municipal decisions-makers and local business experts are in an excellent position to pass information between different stakeholder groups

All managers (municipal, state and federal) are sharing information between them but state and federal agencies interact less with other groups (other than concerned citizens to seek to engage with them)

Large private landowners are an important stakeholder that should be better included in wildfire management communication networks

CURRENTLY…. PHASE 2

Workshop with all Stakeholders

Report back on our findings

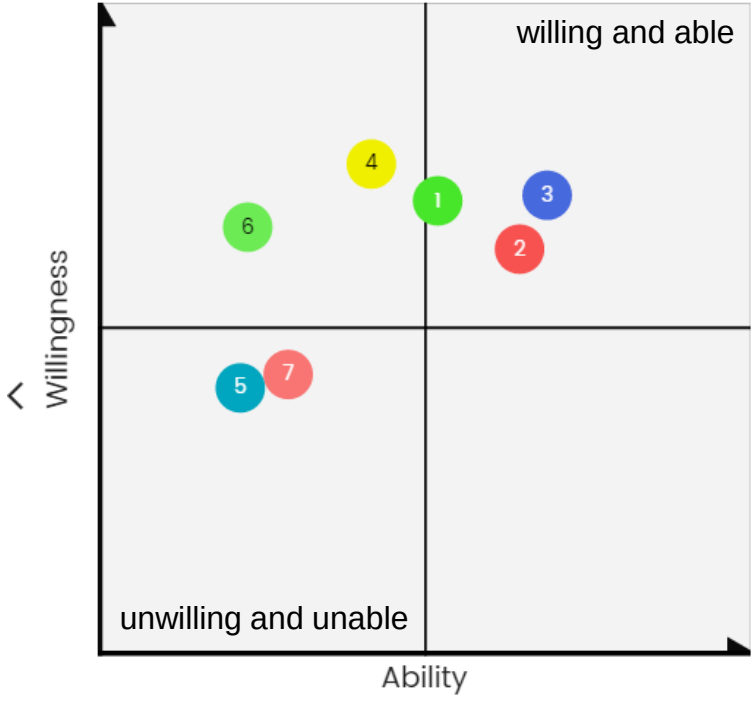
Break out groups: each group works with one of the five models

- to identify barriers
- to brainstorm solutions

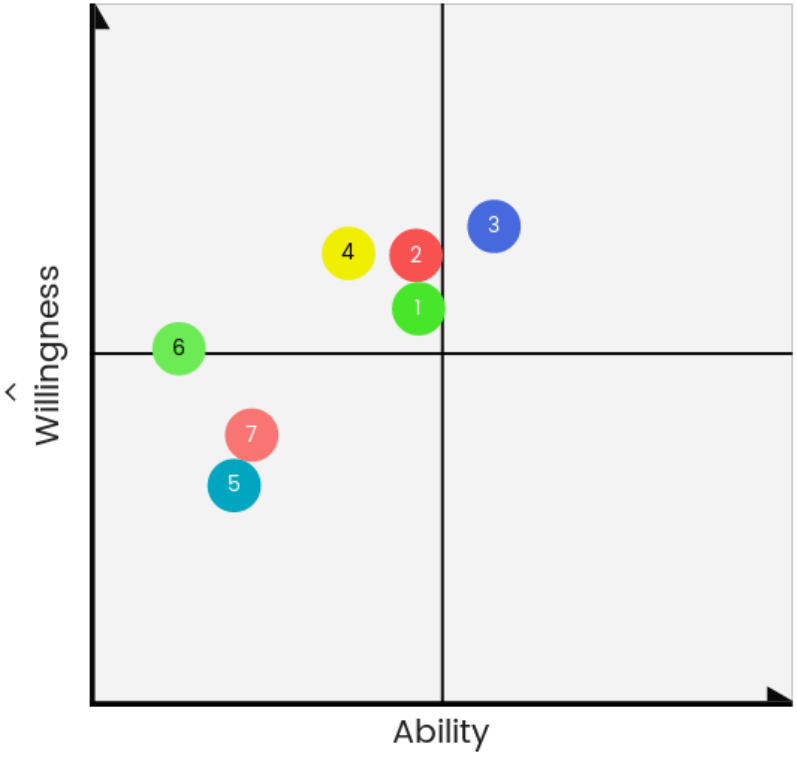
Kick off planning meeting

WHAT INSIGHTS DO WE GAIN FROM THE ALL-STAKEHOLDER WORKSHOP?

HOW WILLING AND ABLE ARE THESE ORGANIZATIONS TO "BRING BACK FIRE"?



1. City/County Leadership
2. BLM
3. US Forest Service
4. Non-government Organizations (e.g. TNC)
5. General Public
6. Academic Experts
7. Citizen Initatives



1. City/County Leadership
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6. Academic Experts
7. Citizen Initatives

Change in perception of …

	Ability	Willingness
City/County Leadership	-0.5	-1.1
BLM	-1.8	0.0
US Forest Service	-1.1	-0.2
Non-government Organizations	-0.5	-1.1
General Public	-0.2	-0.9
Academic Experts	-1.0	-1.5
Citizen Initatives	-0.6	-0.5

(Scale 1-10)

With City/County Model	With Landowner Model	With BLM Model	With US Forest Service Model
Mismatch in scale: private, local, state-wide: • What matters to one group, is relatively unimportant to another • State policies are too large-scale	Liability of the landowner for any damages from escaped fire	Budget for fire management	Liability of the decision maker, who will be held responsible for escaped fire
Smoke is perceived to be a bad thing, independent of air quality: it signals that something bad/dangerous is happening	Landowners are reluctant to engage with government (fear of regulation)	Public acceptance of an extended fire season (smoke until November) implying health risks for the population	Public does not like smoke: it suffers from wildfire smoke already and does not want 'added' prescribed fire smoke.
Coordination between agencies	Lack of awareness/eligibility of existing programs that can provide expertise on how to manage the land	Landscape integrity as the forest could be severely damaged.	Air Quality Act: wildfire smoke is not regulated, prescribed burns are regulated
Budget for fire management	Limited water supply that makes prescribed fire expensive	Decrease of recreation potential with a direct risk to Ashland area tourism	Outreach to inform about prescribed fire has too little lead time to be useful to the public
	Cost to landowner	Density of the forest bringing hardship in the control of prescribed burns and natural ignitions	Cultural perception of smoke
	No 'trigger' to take action, even if need is fully understood	Escaped fires with the liability of BLM employees and the risk of loosing their job	

"LAUNDRY LIST" OF IDEAS FOR A SOLUTION (1)

Smoke & culture surrounding smoke

- With regard to air quality, regulate prescribed burns like wild fire
- Community-level initiatives ("Burn block party")
- More technical information to the public so that they understand the logic of burn operations and are less fearful
- Change mop-up practice after prescribed fire to model that "zero fire" is not necessary to be safe
- Prompt public notice when a prescribed burn is approved

Risks

- Mitigating fuel loads
- Better management of controlled fires especially natural ignition

"LAUNDRY LIST" OF IDEAS FOR A SOLUTION (2)

Liability for landowners, fire managers

- Spread liability (not only Burn Boss, not only landowner)
- Cap amounts
- Provide free legal aid to landowners (after they have passed an exam) if they are accused of damages

Outreach and Education

- Appeal to landowners' independence (similar to Smokey The Bear: Only you can make it happen on your land)
- Have a single point of contact for landowners (possibly not government run) that pools all information about all programs

"LAUNDRY LIST" OF IDEAS FOR A SOLUTION (3)

Policy

- Land swap in order to avoid checkerboards
- Adjust policies to make scale-appropriate decision making possible

Other recommendations

- Increase fire management budgets
- Improve coordination between key players
- Increase outreach and education

WORKING WITH A STAKEHOLDER GROUP MODEL

From the participants' perspective

… challenging, not easily accessible

… appears to be useful as a creativity tool

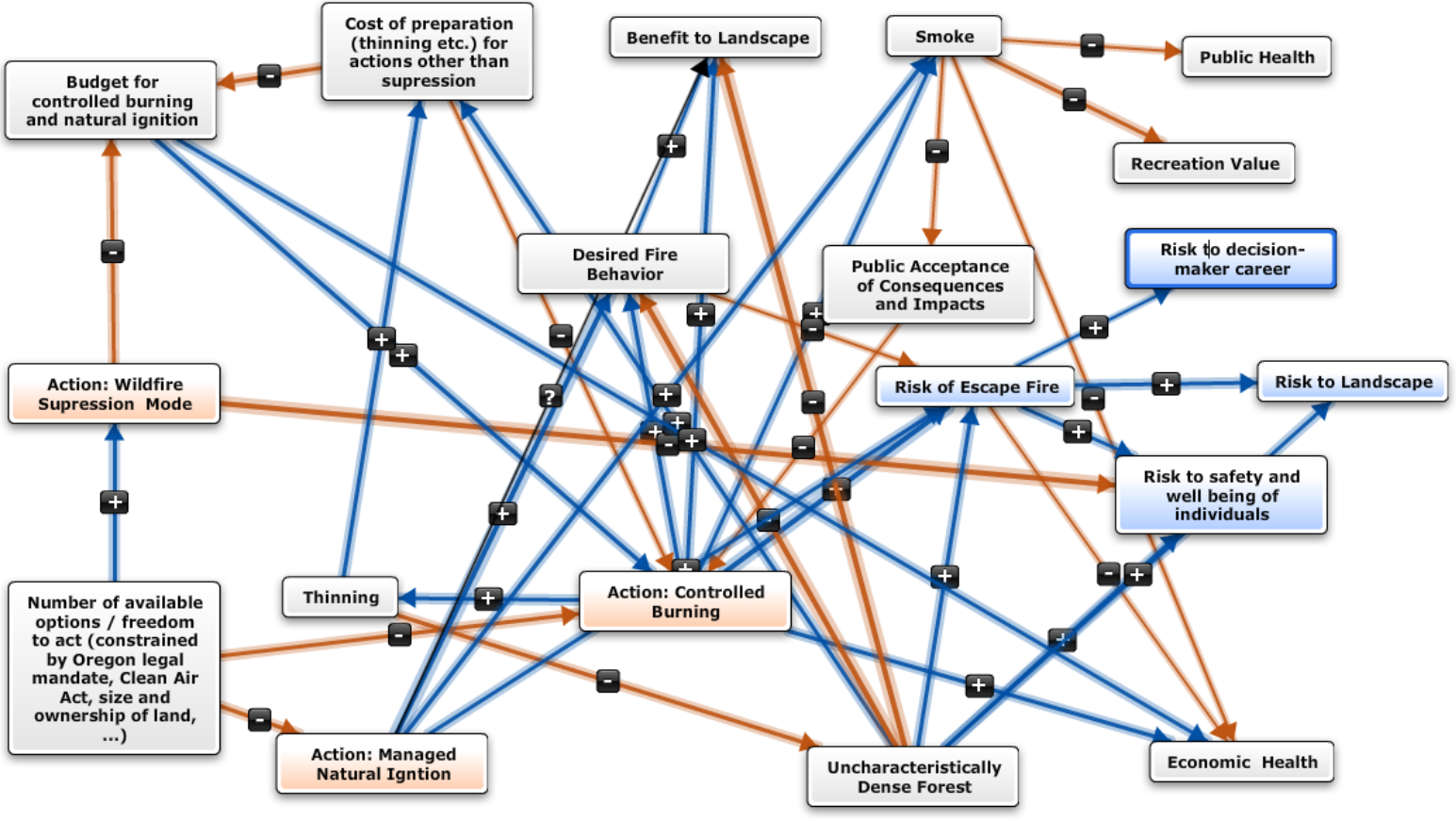
… may increase understanding for other stakeholders

DATA ANALYSIS STILL ONGOING

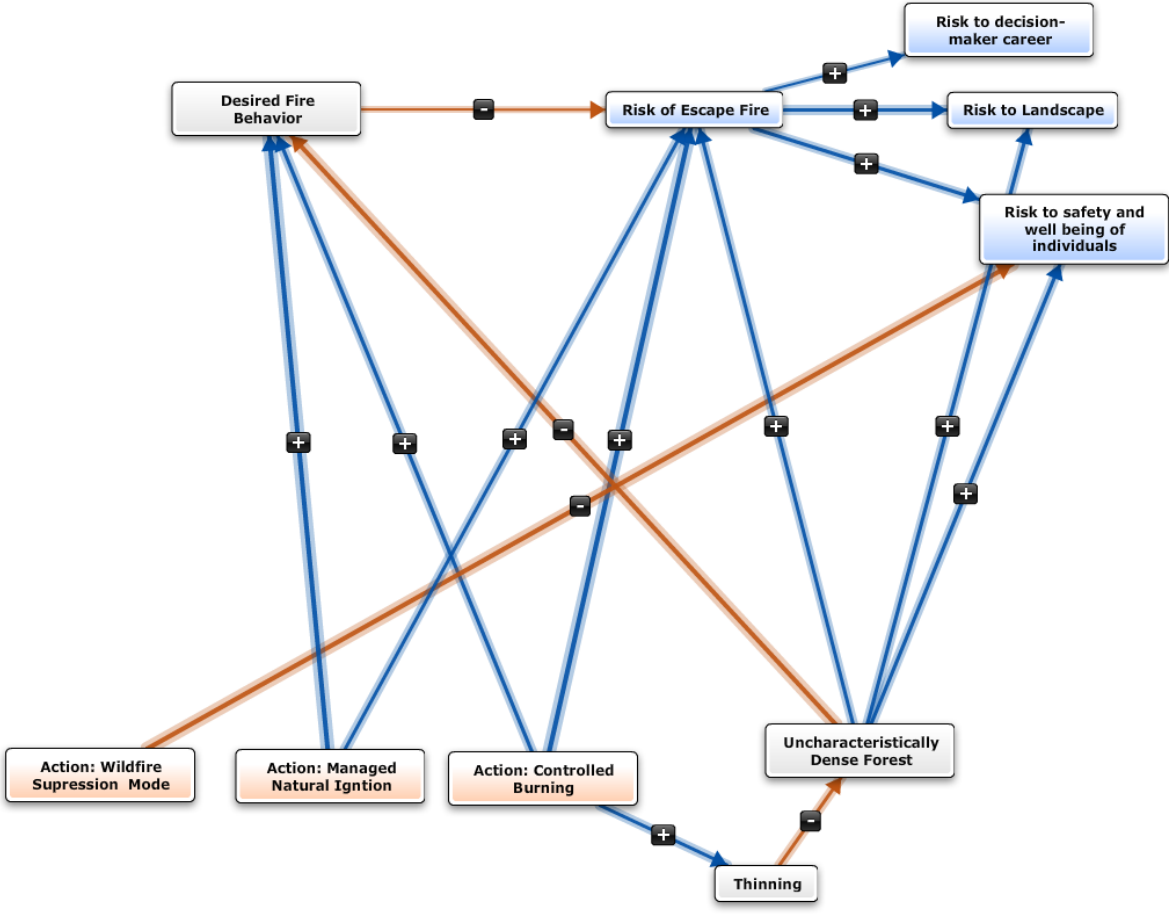
Thank you

BACKUP SLIDES

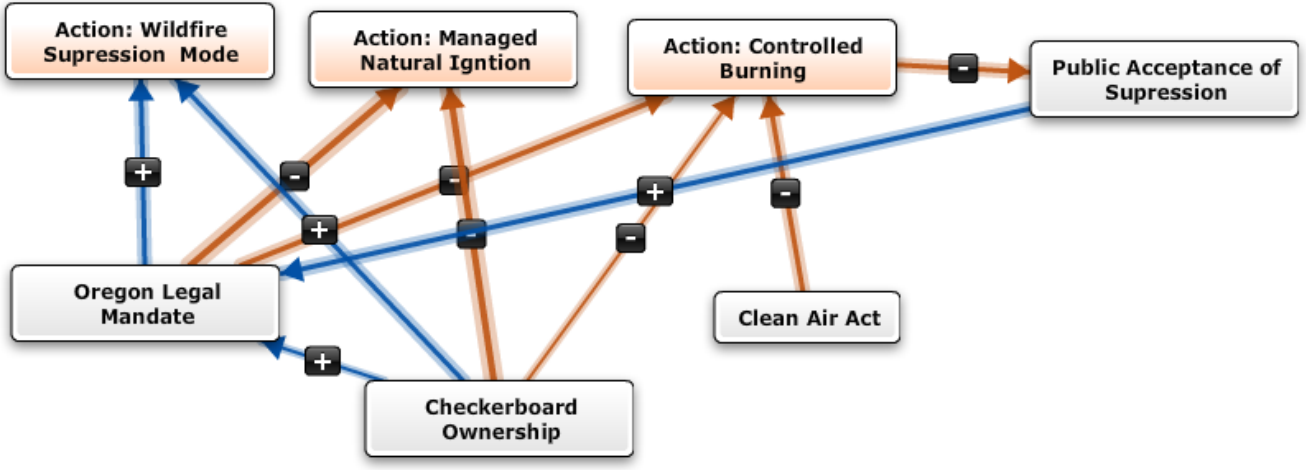
BUREAU OF LAND MANAGEMENT



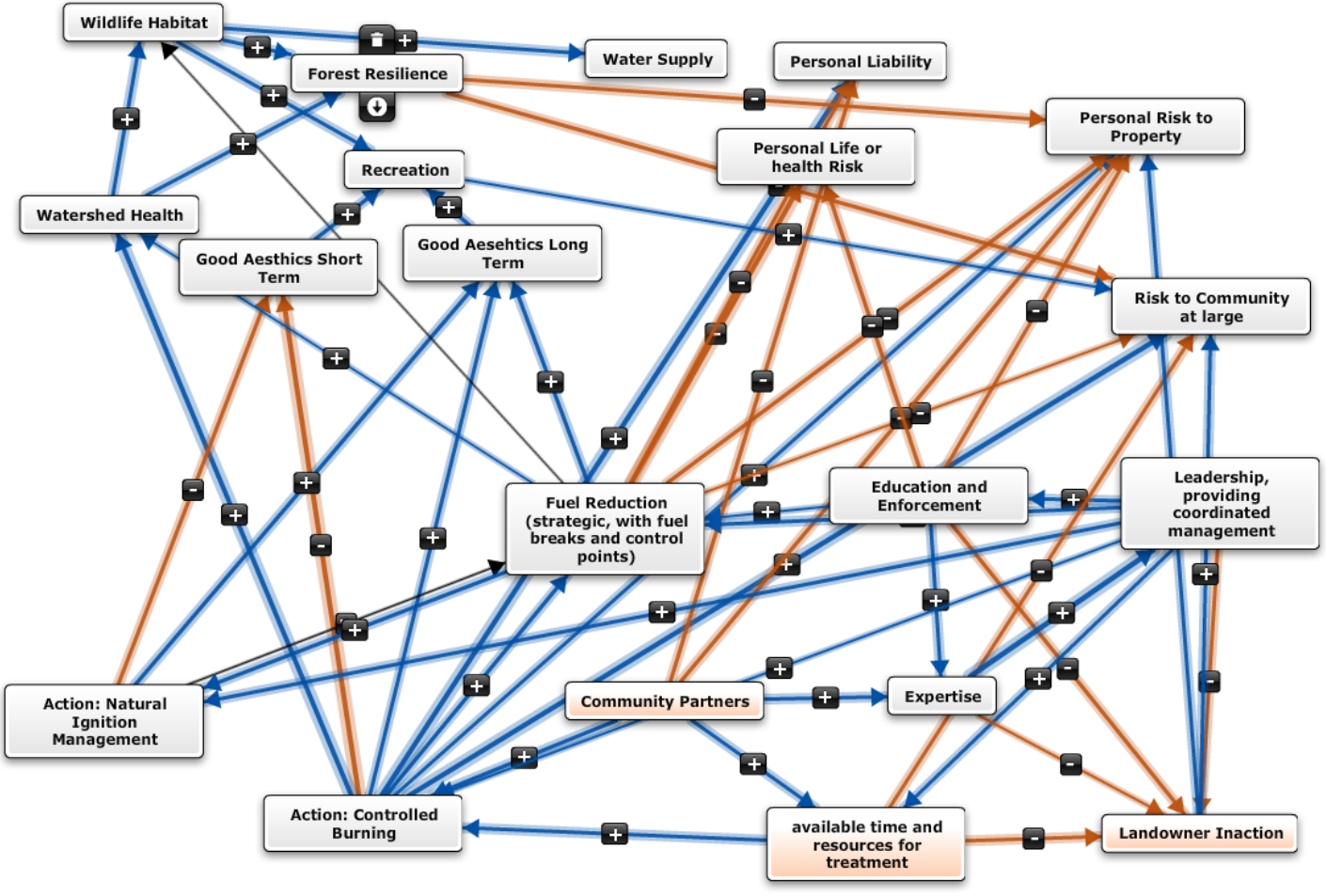
WORKSHOP 3 – GROUP INSIGHTS: RISKS & CONSTRAINTS



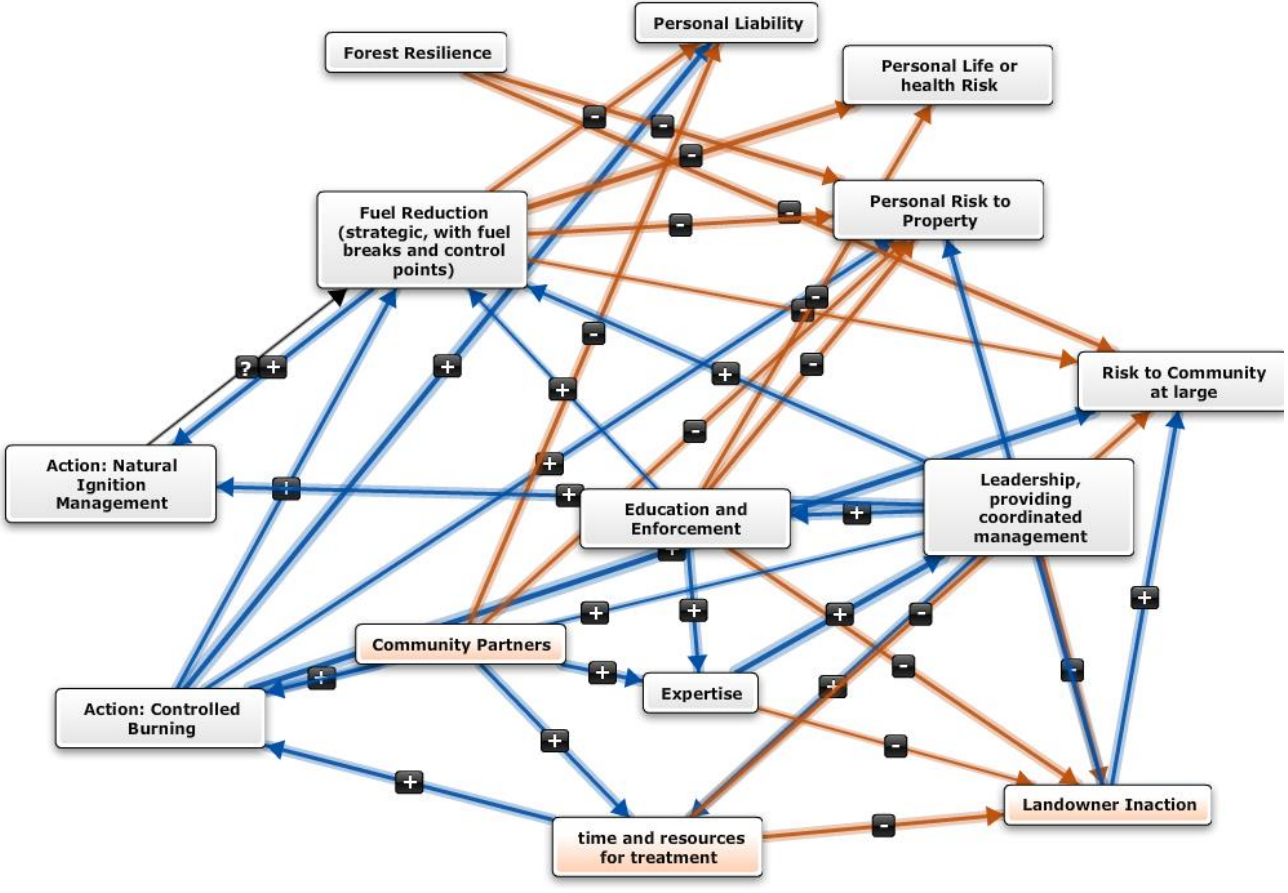
WORKSHOP 3 – SUB MODELS: CONSTRAINTS



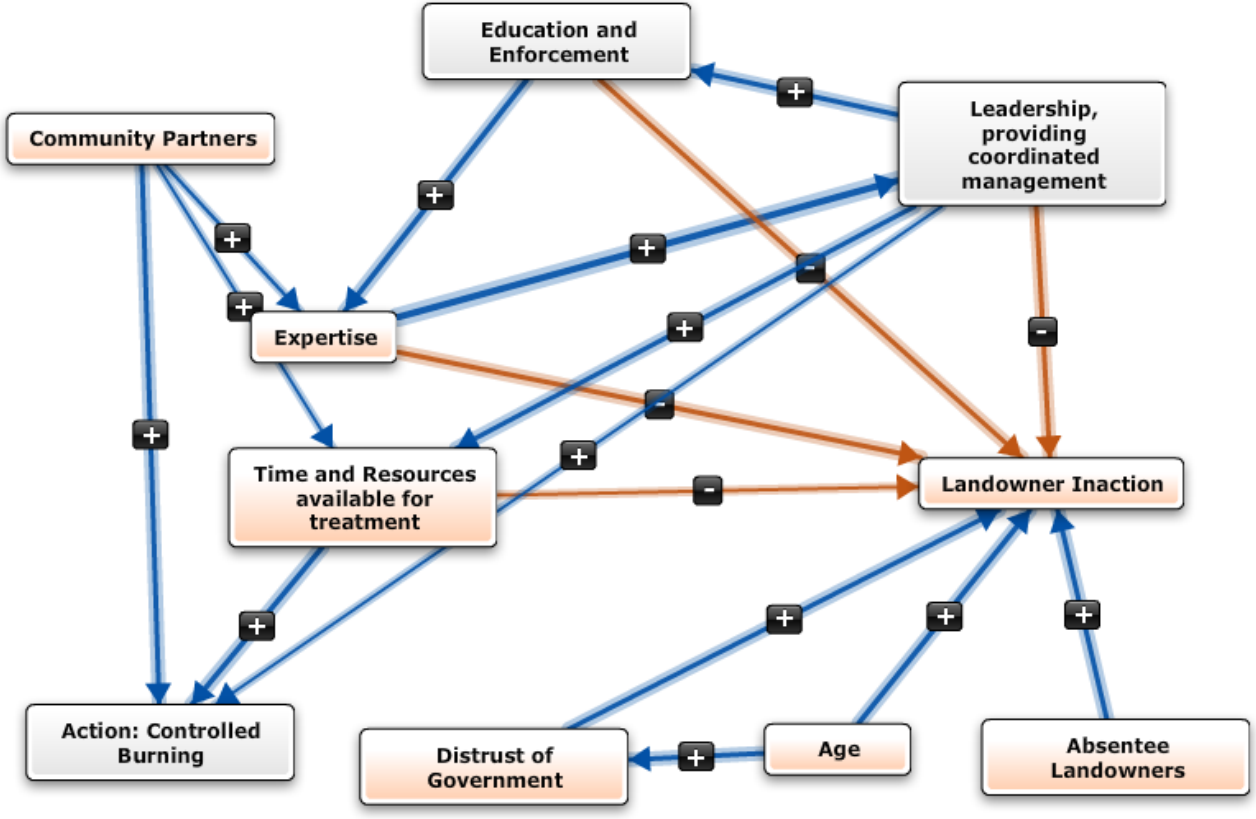
WORKSHOP 4 – LANDOWNERS



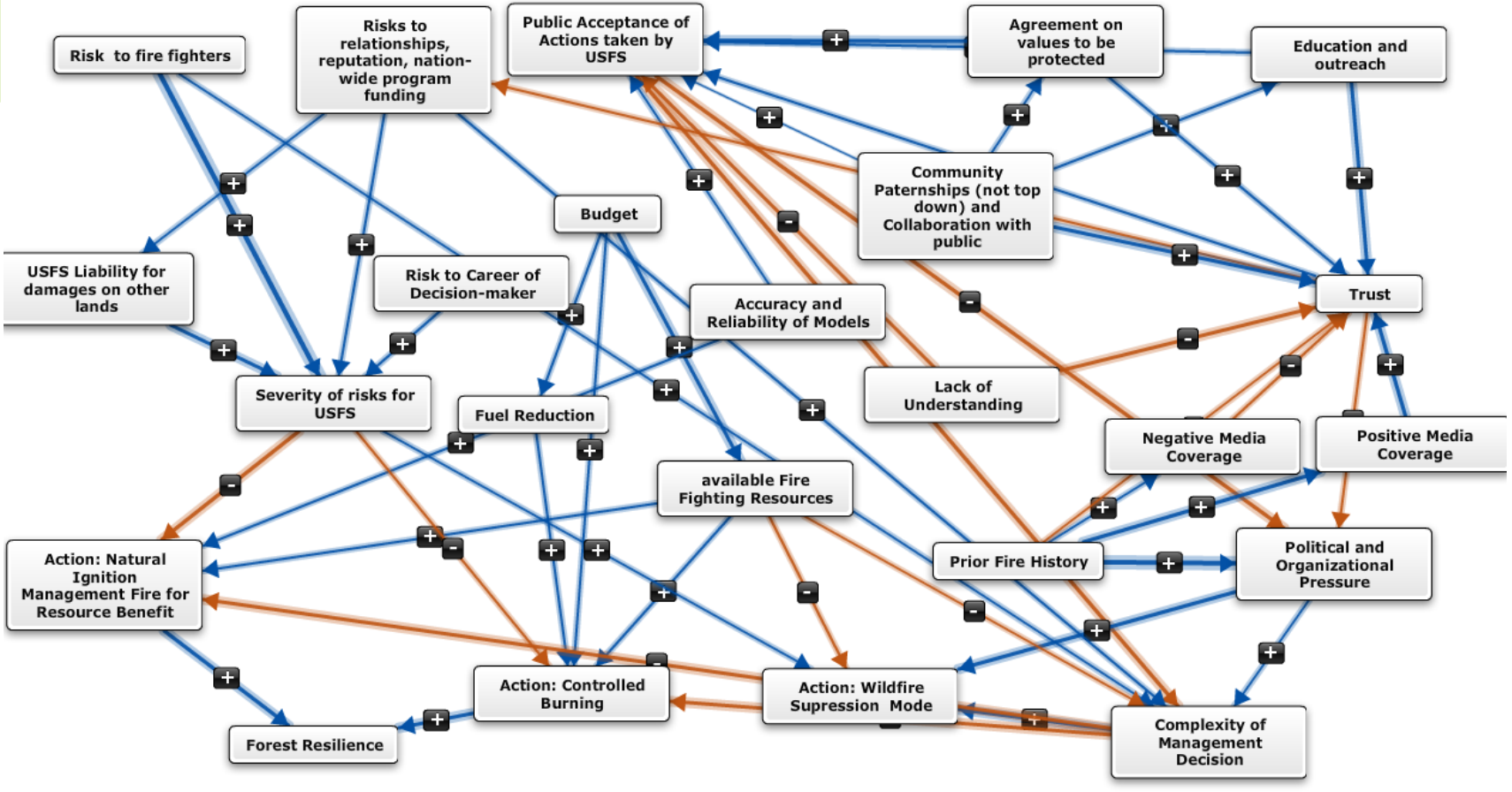
WORKSHOP 4 – GROUP INSIGHT: RISKS



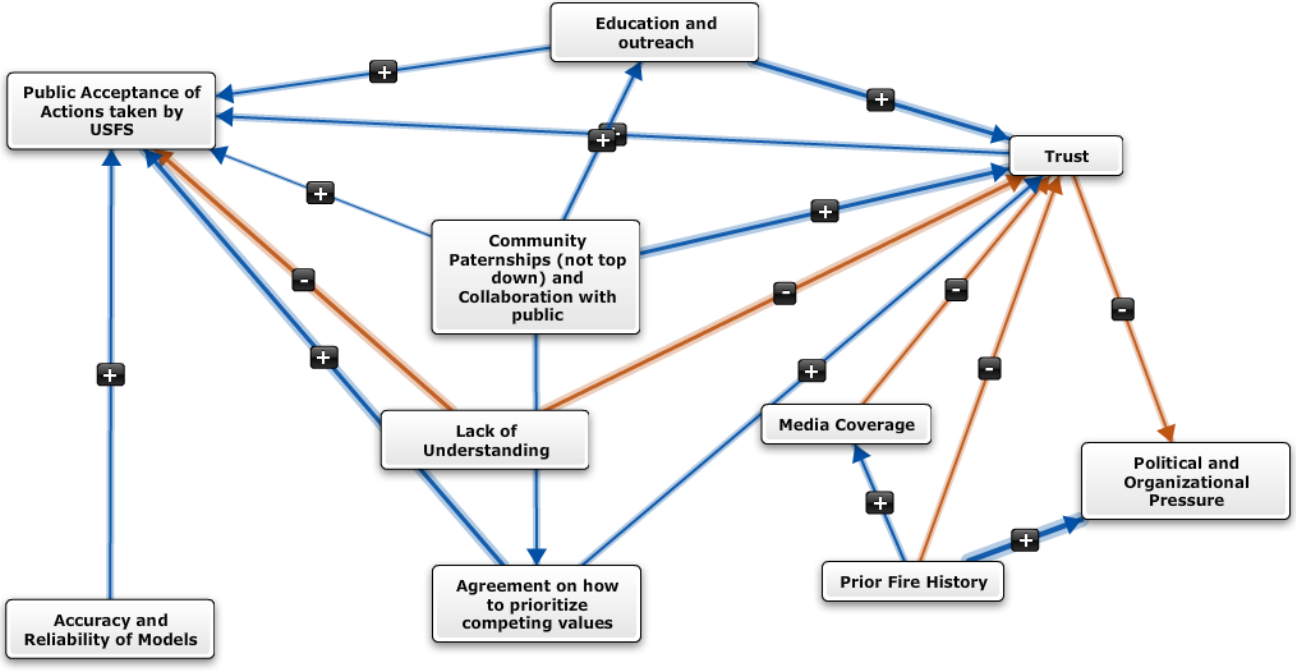
WORKSHOP 4 – GROUP INSIGHT: DRIVERS OF LANDOWNER INACTION



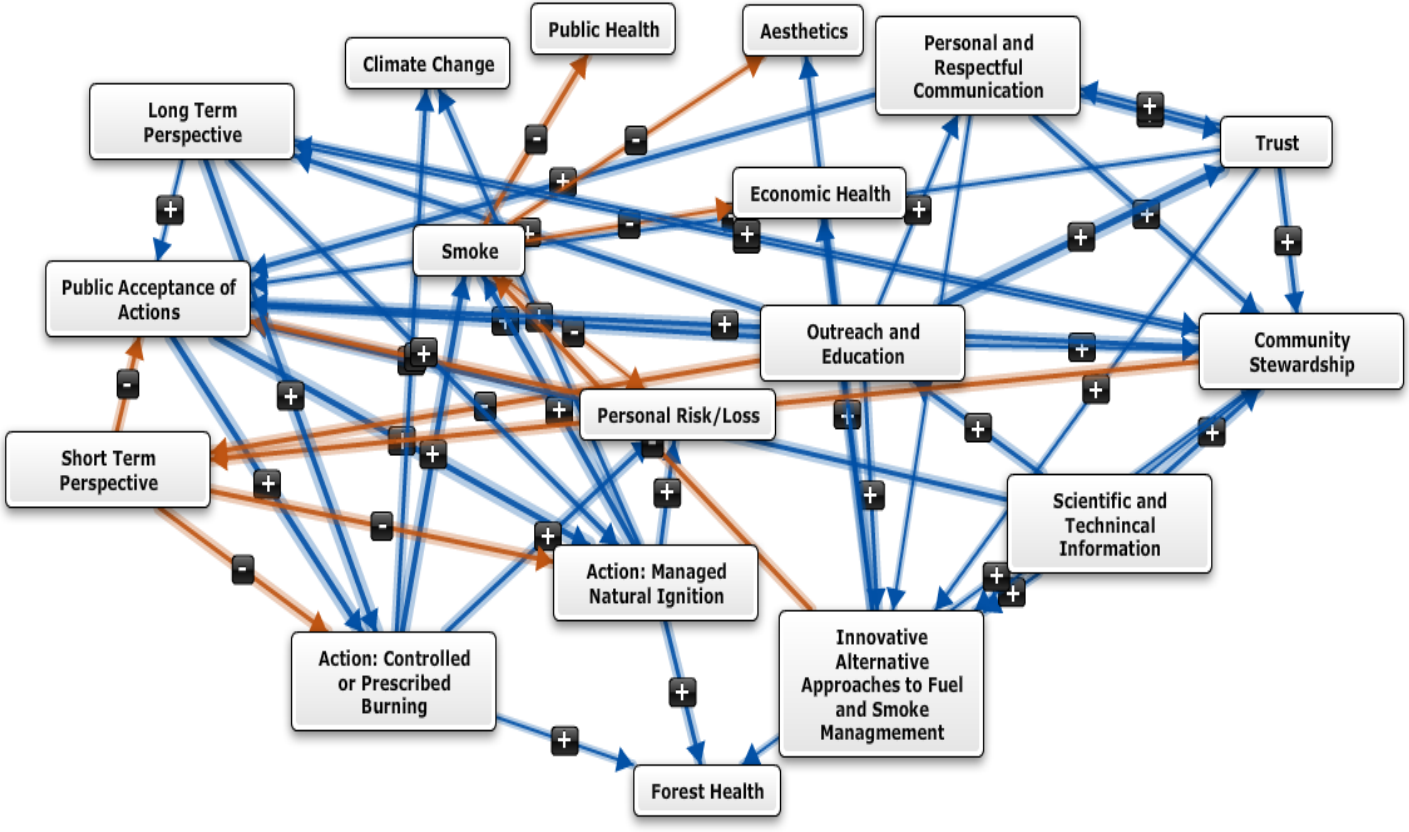
WORKSHOP 5 – US FOREST SERVICE



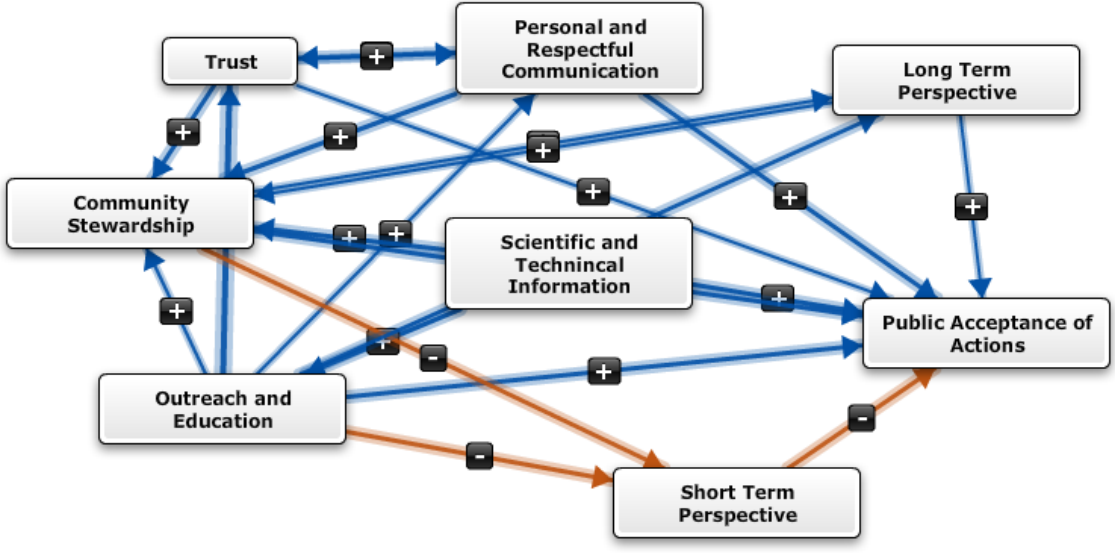
WORKSHOP 5 – GROUP INSIGHT: TRUST AND ACCEPTANCE



CITY/COUNTY LEADERSHIP



WORKSHOP 1 — GROUP INSIGHT: COMMUNITY OUTREACH, STEWARDSHIP, TRUST, AND PUBLIC ACCEPTANCE



BARRIERS IDENTIFIED BY THE BREAK OUT GROUPS

With City/County Model	With Landowner Model	With BLM Model	With US Forest Service Model
Mismatch in scale: private, local, state-wide: • What matters to one group, is relatively unimportant to another • State policies are too large-scale	Liability of the landowner for any damages from escaped fire	Budget for fire management	Liability of the decision maker, who will be held responsible for escaped fire
Smoke is perceived to be a bad thing, independent of air quality: it signals that something bad/dangerous is happening	Landowners are reluctant to engage with government (fear of regulation)	Public acceptance of an extended fire season (smoke until November) implying health risks for the population	Public does not like smoke: it suffers from wildfire smoke already and does not want 'added' prescribed fire smoke.
Coordination between agencies	Lack of awareness/eligibility of existing programs that can	Landscape integrity as the forest could be severely damaged.	Air Quality Act: wildfire smoke is not regulated, prescribed burns are

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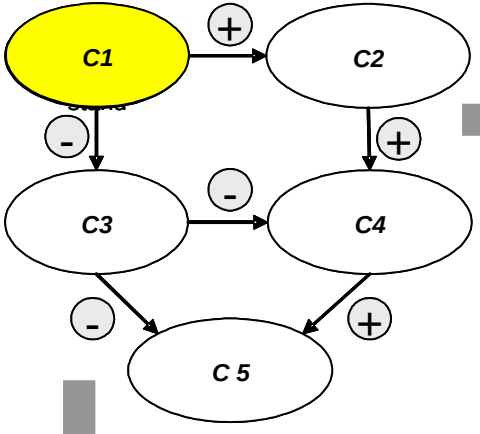
BASIC CALCULATION



	C 1	C 2	C 3	C 4	C 5
C1	0	1	-1	0	0
C2	0	0	0	1	0
C3	0	0	0	-1	-1
C4	0	0	0	0	1
C5	0	0	0	0	0

adjacency matrix

(1 0 0 0 0)

Statevector

- Multiplication of state vector with adjacency matrix
- resulting concept states and squashing function deliver new vector
- “Spreading Activation“
- system settles down quickly